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ORIGINAL ARTICLE

MORPHOMETRICAL CLUTCH UNIFORMITY IN THE LAPWING COMMUNITY *VANELLUS* BRISON, 1760 (AVES, CHARADRIIFORMES, CHARADRIIDAE) IN AL-MALIH WETLAND-BABYLON PROVINCE- MIDDLE OF IRAQ

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ABSTRACT

In this study, we provide an analytical comparison combined with morphological characteristic of eggs and newly hatched precocial chicks of three lapwing species, Red–owattled Lapwing *Vanellus indicus* (Boddaert, 1783), Spur-winged Lapwing *V. spinosus* (Linnaeus, 1758), and White-tailed Lapwing *V. leucurus* (Lichtenstein, 1823) that breed in Al-Malih Wetland in Babylon Province, Middle of Iraq. Occupied nests were located during the breeding season (March–June 2023), breeding events (e.g., adult courtship, marking of the breeding territories, nest-site selection, nest building, and egg incubation) were carefully observed. A total of 48 eggs from a total of 12 lapwing nests (4 eggs for each nest, 4 nests for each species) were cautiously examined and measured. Lapwing chicks and eggs show many morphological differences. Morphometrical data were tested using ANOVA, calculating the Mean, standard deviation (SD), and coefficient of variation (CV). The mean and SD for egg length were 46.25±0.68 mm for *V. indicus*, 42.25±0.96 mm for *V. spinosus* (Linnaeus, 1758), and 42.28±0.67 mm for *V. leucurus*. The egg breadth mean and SD were 33.34±0.84 mm for *V. indicus*, 31.43±0.55 mm for *V. spinosus* (Linnaeus, 1758), and 31.42±0.67 mm for *V. leucurus*. The egg weight Mean and SD were 21.39±0.91 gm for *V. indicus*, 16.51±0.73 gm for *V. spinosus* (Linnaeus, 1758), and15.87±0.50 gm for *V. leucurus*. The low value of CV (≤5%) may indicate a close hereditary clan in the birds that belong to the same genus. In addition, the results indicate that there are considerable differences in the morphometrical measurement of the three species of *Vanellus*. Eggs, as all of these variables have ≤5% CV. Our preliminary results, which were obtained for the first time, may contribute to the conservation efforts of these wetlands-dwelling birds in Iraq.

Keywords: Biology birds, Birds of Iraq, Egg measurements, Lapwing community, Water bird .

INTRODUCTION

Wetlands support a high diversity of resident and migrant waterbirds (Amezaga *et al.*, 2002). One of the basic benefits of wetlands is that they provide a suitable habitat for plants and animals that live primarily in these regions; for example, migratory birds are considered the main users of wetlands for foraging, resting, and roosting sites (Ma *et al*., 2010). Lapwings are members of the family Charadriidae, which typically nest on wetland edges, grasslands, or sandy beaches, feeding on nematodes, worms, insects, and crustaceans, especially their larvae in aquatic settings (Shrubb, 2010). According to Salim *et al*., (2012), there are five species of lapwings belonging to the genus *Vanellus* in Iraq, including Red-wattled Lapwing *V. indicus* (Bo ddaert, 1783) , Spur-winged Lapwing *V. spinosus* (Linnaeus, 1758), White-tailed Lapwing *V. leucurus*, Sociable Lapwing *V. gregarious* and Northern Lapwing *V. vanellus.* The first three species were breeding residents, while the latter are rare passage migrants and winter visitors (Al-Sheikhly, 2021).

According to historical works of literature review like Chapman and McGeoch (1956) there were recorded nests of *V. indicus* (Boddaert, 1783), *V. leucurus* (Lichtenstein, 1823) and *V. spinosus* (Linnaeus, 1758) in Al- Habbaniyah; Moore and Boswell (1956) recorded eggs on 12, 19 April, and 26 May 1955 of *V. indicus* (Boddaert, 1783) in Iraq. Allouse (1961) described the lapwing *Vanellus* spp. in Iraq (morphological, recorded, and status) and referred to *V. indicus* (Boddaert, 1783) as a resident , *V. leucurus* (Lichtenstein, 1823) as a resident and winter visitor, *V. gregaria* as a rare winter visitor, *V. vanellus* as a winter visitor, and *V. spinosus* (Linnaeus, 1758) as a resident. However, the study that briefly described the temporal breeding biology of *V. leucurus* (Lichtenstein, 1823) and *V. spinosus* (Linnaeus, 1758) was made by Al-Robaae (2006), he mentioned that *V. leucurus* (Lichtenstein, 1823) nests are found in late May and early June, while *V. spinosus* (Linnaeus, 1758) nests were found in June, which are small holes near the water's surface and contain 3 or 4 eggs; also he mentioned that *V. indicus* (Boddaert, 1783) nests and eggs were discovered in May and June. Abed (2007) recorded two species of lapwing, *V. leucurus* (Lichtenstein, 1823) and *V. indicus* (Boddaert, 1783) at three sites: Huwayzah, Suq Shuyukh and East Hammar belonging to restored southern Iraqi marshes. Salim *et al*. (2009) referred to those four species of lapwing recorded in the marshes of southern Iraq, as Northern Lapwing *V. vanellus* was a winter visitor.*V. spinosus* (Linnaeus, 1758)as resident breeder and winter visitor; *V. indicus* (Boddaert, 1783) as resident breeder and winter visitor; and *V. leucurus* (Lichtenstein, 1823) as resident breeder and winter visitor. Fazaa *et al*. (2017) indicated that the three species of lapwings mentioned above are breeding in the Central Marshes based on the British Trust for Ornithology's breeding evidence.

In addition, Habeeb *et al*. (2018) recorded three species of lapwing, including *V. leucurus* (Lichtenstein, 1823), *V. spinosus* (Linnaeus, 1758) and *V. indicus* (Boddaert, 1783) in the East Hammer Marsh in Basra. Also Abbas (2022) recoded the species of *V. indicus* (Boddaert, 1783) from the lapwing *V. indicus* (Boddaert, 1783) in Basra.

In this study, we aim to obtain (i) a morphometrical comparison/differences among clutches and (ii) a contrasting morphological description of the newly hatched chicks of three species of *Vanellus* lapwing.

MATERIALS AND METHODS

Study site: Al-Malih wetland (Map 1) is located in the northern part of Babylon Province (N 32°48'56", E 44°20'37") and south of Baghdad (about 54.78 km) and covers 2,000 hectares (20 km^2) area. However, it receives water from the Euphrates River through two channels that pass through it. There are a lot of fish farms there and also wetlands, especially in the winter season. The general landscape is dominated by freshwater open lakes with cover provided by the dominant common reed *Phragmites australis* (Cav.) Trin. ex Steud., 1841.

Field work: The study was conducted during the breeding season (March–June 2023) for 60 days (15 days per month) from 6:00 a.m. to 12:00 p.m. A popular technique for finding nests is cold searching, which involves looking visually for breeding events (e.g., adult courtship, marking of the breeding territories, nest-site selection, nest building, and egg incubation) that were carefully observed. Potential bias of this kind can be avoided for species that are easily observed by first locating a bird, then observing its return to its nest during visits for nest construction, incubation changeovers, or feeding nestlings by using a digital camera (Nikon Coolpix P900s, Japan), binoculars (Ansinna, 12x40), The efficiency with which nests can be detected in this manner can be boosted if the observer is aware of the relevance of special clues provided by behavior or warning signs (Sutherland *et al*., 2004). To relocate nests natural markers, such as stones arranged in a particular way to mark the nests to reduce predation risk, and global positioning systems (GPS) that enable you to navigate quickly to the correct landmark (Pietz and Granfors, 2000). 48 eggs from 12 *Vanellus* species nests (4 nests per species, each nest contains 4 eggs) were recorded; egg length and breadth were taken by using a Vernier calliper (0.01 mm) accuracy, and egg weight was taken by a sensitive scale (0.001 gm).

Identification field guides: Many ornithological classification field guides were employed during the study to achieve precise morphological identification of lapwing species. The following field guides were used and are organized by year of publication: Allouse (1961), Svensson *et al*. (2010), and Porter and Aspinall (2013).

Data Analysis: ANOVA (LSD 0.05) within the SPSS program (IBM, V. 26) was used to calculate the Mean, Standard Deviation, and Coefficient of variation of egg measurements. The Duncan multiple range test was employed to examine the variances among the means (Tallarida, 1987). Pearson correlation test was used to test the differences between the means (Ross and Willson, 2017).

RESULTS AND DISCUSSION

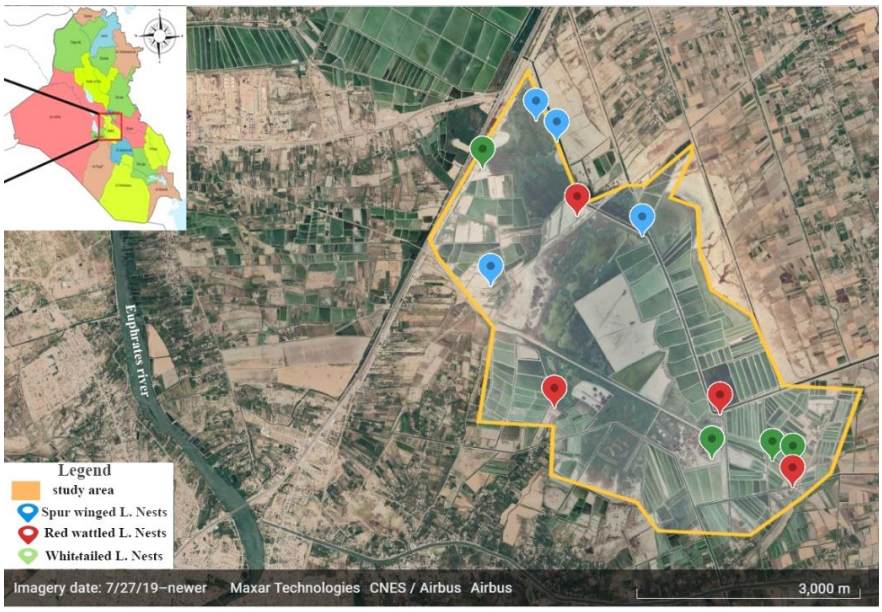
V. spinosus (Linnaeus, 1758) nests and chicks shown in Plate (1), eggs outwardly are distinguished by a pyriform shape, a non-glossy surface with olive green to light brownish colour, and were patterned with irregularly sized dark brownish black spots and streaks. The

chick morphology was distinguished by dark brown in the base bill ended black, brown iris, and pale green legs. A small black stripe extends from the eye ring, and a distinct black stripe on the crown base with a sandy head contains small black spots. Nape, chin, throat, and downside parts are distinct with white color. *V. indicus* (Boddaert, 1783) nests and chicks shown in Plate (2), eggs outwardly are distinguished by their pyriform shape and non-glossy surface; their color is pale olive green with black spots. The chick has a dark brown bill, a brown iris, and pale green legs. The black distinct stripe on the crown base with sandy head contains a small black spotted with a black throat. The black strip on the flank extends to the tail. Nape, chin, and downside parts are distinct with white color. *V. leucurus* (Lichtenstein, 1823) nests and chicks shown in Plate (3), eggs outwardly are distinguished by pyriform shape and non-glossy surface with pale olive eggs with large irregular dark-brown stained patterns. The chick has a black bill, brown iris, and green legs. Spotted a distinct black pattern on the sandy buff head and back. White stripe on the nape and chin, throat, and downside parts.

The mean, standard deviation, and coefficient of carination for the egg's external morphological characteristics are displayed in Table (1). The mean and standard deviation for egg length were (46.25±0.68, *V. indicus* (Boddaert, 1783). (42.25±0.96, *V. spinosus* (Linnaeus, 1758), (42.28±0.67, *V. leucurus*); the highest significant value (46.25±0.68mm) was belonging to *V. indicus* (Boddaert, 1783), the differences in this trait according to different species of lapwing *Vanellus* were high significant (P-value less 0.001). Kaur and Khera (2017) study on *V. indicus* (Boddaert, 1783) found that egg length was less than this study (41.29±0.573 mm). Özkan *et al*. (2012) indicated to *V. spinosus* (Linnaeus, 1758) egg length measurement mean that calculated for two years ($Mean_{2010,}$ 40.8±0.22 – $Mean_{2011,}$ 40.3±0.13). Egg breadth mean and standard deviation were (33.34±0.84, *V. indicus* (Boddaert, 1783), (31.43±0.55, *V. spinosus* (Linnaeus, 1758), (31.42±0.67, *V. leucurus*); the significant value was in *V. indicus* (Boddaert, 1783) and the differences among the values of lapwing *Vanellus* were significant ($p \leq 0.05$). Kaur and Khera (2017) reported that egg breadth was slightly different between two years (2012, 2013), which were (29.89 mm and 30.39 mm) respectively. Özkan *et al*. (2012) indicated to *V. spinosus* (Linnaeus, 1758) egg width mean ($Mean_{2010,}$ 29.006 ±0.08 – $Mean_{2011,}$ 28.790±0.07). Egg weight mean and standard deviation were (21.39±0.91, *V. indicus* (Boddaert, 1783), (16.51±0.73, *V. spinosus* (15.87±0.50, *V. leucurus*). The high significant value was in *V. indicus*, and the differences among the values of species were high significant ($p \leq 0.001$). Özkan *et al*. (2012) indicated to *V. spinosus* (Linnaeus, 1758) egg weight mean ($Mean_{2010,}$ 16.8±0.14 – $Mean_{2011,}$ 16.9±0.10).

The environment, the amount of food available, the size of the parents, and the evolutionary stage all have an impact on the external egg features generally in bird species (Stadelman *et al*., 2017), and to female differences like age (Föger and Pegoraro, 1996). Environmental or genetic factors could be responsible for this difference (Kaur and Khera, 2017). Several researchers employed the Coefficient of Variation (CV) for the egg's exterior, and it does signal for closely relative species (Shaker *et al*., 2019). The values of CV in the current study ranged between (1.47, 2.51, 4.27 for *V. indicus* (Boddaert, 1783); 2.26, 1.76, 4.44 for *V. spinosus* (Linnaeus, 1758); and 1.57, 2.13, 3.16 for *V. leucurus* (Lichtenstein, 1823)

respectively. The Pearson correlation between different species of Lapwing *Vanellus* in Table (2) shows a significant value among *V. indicus* (Boddaert, 1783), *V. spinosus*, and *V. leucurus* where (p -value less 0.05) and a high significant value between *V. spinosus* and *V. leucurus* where (p-value less 0.001). In Table (3) the study area with the nests location of lapwing *Vanellus* species are shown.



Map (1): Study area with Nests location of lapwing *Vanellus* spp. (Map from Google earth explore).

Plate (1): *V. spinosus*; Nests (1, 2, 3, 4) and Chick (5).

Plate (2): *V. leucurus*; Nests (1, 2, 3, 4) and Chick (5).

Plate (3): *V. leucurus*; Nests (1, 2, 3, 4) and Chick (5).

Table (1): Morphological Comparison between different species of *Vanellus*.

Lapwing Genus	Egg length (mm)		Egg breadth (mm)		Egg weight (gm)	
	Mean±SD	CV	Mean±SD	C	Mean±SD	CV
Red-wattled lapwing (*Vanellus indicus*)	46.25±0.68 A	1.47	33.34±0.84 A	2.5	21.39±0.9 A	4.27
Spur-winged lapwing (*Vanellus spinosus*)	42.25±0.96 B	2.26	31.43±0.55 B	1.7	16.51±0.7 B	4.44
White-tailed lapwing (*Vanellus leucurus*)	42.28±0.67 B	1.57	31.42±0.67 B	2.1	15.87±0.5 B	3.16
ANOVA ($LSD_{0.05}$)	3.953		1.909		5.384	
P – value	0.001 HS		0.034 S		<0.001 HS	

Table (2): Pearson correlation between different species of Lapwing *Vanellus*.

Correlations		Red-wattled lapwing	Spur-winged lapwing	White-tailed lapwing
Red-wattled lapwing (*Vanellus indicus*)	Pearson Correlation	———	0.637*	0.542*
	p – value		0.031	0.047
Spur-winged lapwing	Pearson Correlation	———	———	0.853**

(*Vanellus spinosus*)	P – value			<0.001
White-tailed lapwing (*Vanellus leucurus*)	Pearson Correlation	——	——	——
	P – value			

Table (3): Lapwing nests GPS coordinators.

No.	*Vanellus* species	Coordinators
1.	*V. indicus*	N 32°48'11", E 44°21'30"
2.	*V. indicus*	N 32°49'38", E 44°20'14"
3.	*V. indicus*	N 32°48'14", E 44°20'02"
4.	*V. indicus*	N 32°47'40", E 44°22'06"
5.	*V. leucurus*	N 32°49'58", E 44°19'25"
6.	*V. leucurus*	N 32°47'52", E 44°21'24"
7.	*V. leucurus*	N 32°47'51", E 44°21'55"
8.	*V. leucurus*	N 32°47'49", E 44°22'06"
9.	*V. spinosus*	N 32°49'29", E 44°20'48"
10.	*V. spinosus*	N 32°49'07", E 44°19'30"
11.	*V. spinosus*	N 32°50'10", E 44°20'04"
12.	*V. spinosus*	N 32°50'19", E 44°19'53"

CONCLUSIONS

Our results indicate that there are considerable differences in the morphological Clutch Uniformity in the lapwing species community. The significant differences between three species of lapwing, *V. indicus* (Boddaert, 1783), especially they differ from *V. spinosus* (Linnaeus, 1758) and *V. leucurus* (Lichtenstein, 1823) in egg measurements, eggs, and chicks morphology of lapwing species showed differences in their morphology, appearance, colors, patterns and all of them were showed for the first time in scientific research. All of these variables according to analysis in SPSS, have ≤5% of a coefficient of variation ((low value) and that may refer the closed related species that belong to the same genus *Vanellus* due to the season of laying eggs, and environments (Shaker *et al*., 2019; Alsalihi *et al*., 2022). The breeding season for lapwing species in this study. Extended for four months (March-June2023) in Al-Maih wetland in suitable habitats, and each species of lapwing chose an independent territory, occupied it during the nesting period and defended it with high parental cares. The parents shared everythings from incubation to protection of the territory. A specific scientific research is needed in the future. Our preliminary results, which were obtained for the first time, may contribute to the conservation efforts of these wetlands-dwelling birds in Iraq.

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CONFLICT OF INTERESTSTATEMENT

The authors declare no conflict of interest. We "the authors" have followed and signed the scientific research ethics announced by the journal.

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دراسة التحليل الكمي لتماثل بيوض مجتمع جنس طيور الزقزاق *Vanellus* Brison, 1760 (Aves, Charadriiformes, Charadriidae) في منطقة المالح الرطبة – محافظة بابل - وسط العراق

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الخلاصة

في هذه الدراسة، اجريت مقارنة احصائية مع وصف مظهري لبيوض وافراخ حديثة الفقس لثلاثة انواع من جنس الططاوي، شملت: الطيطوى المغببة *Vanellus indicus* (Boddaert, 1783)، ابو ظفر *V. spinosus* (Linnaeus,1758)، الزقزاق الابيض الذنب *V. leucurus* (Lichtenstein, 1823) تفرخ في منطقة المالح الرطبة في محافظة بابل وسط العراق. حددت مواقع الاعشاش خلال موسم التكاثر(اذار-حزيران2023)؛ احداث التفريخ مثل تحديد الاقاليم، طقوس التزاوج، اختيار مكان او بناء الاعشاش، كما لوحظت بعناية حضانة البيض. فحصت بحذر 48 بيضة من مجموع 12 عش من اعشاش طيور الزقزاق (4 بيضات لكل عش، 4 اعشاش لكل نوع) مع تسجيل قياساتها. تبين ايضا ان هنالك عدة اختلاقات مظهرية بين افراخ وبيوض طيور الططاوي.

تم تحليل البيانات باستخدام اختبار الانوفا لحساب المتوسط الحسابي والانحراف المعياري ومعامل الاختلاف. كان المتوسط الحسابي والانحراف المعياري لطول البيض كالاتي: 46.25±0.68 للنوع *V. indicus*، 42.25±0.96 ملم للنوع *V. spinosus* (Linnaeus, 1758)و 0.67 ±42.28 ملم للنوع (Lichtenstein, 1823) *V. leucurus*.

كان متوسط عرض البيض 0.84 ± 33.34 ملم للنوع *V. indicus*، 0.55 ± 31.43 ملم للنوع *V. spinosus* (Linnaeus, 1758)، و 0.67±31.42 ملم للنوع *V. leucurus*. سجَّلَ متوسط وزن البيضة 0.91 ± 21.39 غم للنوع *V. indicus*، 0.73 ± 16.51 غم للنوع *V. spinosus* (Linnaeus, 1758) ، و0.50±15.87 غم لطائر *V. leucurus*. قد تشير القيمة المنخفضة لـ CV (أقل او يساوي 5%) ربما تشير الى قرب العشيرة الوراثية للانواع التي تعود لنفس الجنس.

بالاضافة الى ذلك، اشارت النتائج الحالية الى وجود فروقات معنوية في قياسات والتحليل الكمي للبيوض للانواع الثلاثة. قد تساهم نتائجنا الأولية، التي تم الحصول عليها لأول مرة، في جهود الحفاظ على هذه الطيور التي تعيش في الأراضي الرطبة في العراق.