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Induction of sexual activity in male and female farmed ostriches (*Struthio camelus*) with GnRH implant

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ABSTRACT

The annual photoperiodic changes are the most important factor controlling the reproductive activity in birds. A single subcutaneous implant of a slow-release GnRH analogue induced the seasonal reproductive activity in both sex of farmed ostriches. Significant increase in annual egg production and clutch number compared with control group were observed.

Key words: Ostrich, GnRH, Induction reproduction, Eggs production.

RIASSUNTO

INDUZIONE DELL'ATTIVITÀ RIPRODUTTIVA IN MASCHI E FEMMINE DI STRUZZI (*STRUTHIO CAMELUS*) D'ALLEVAMENTO MEDIANTE IMPIANTO DI GNRH

Le variazioni annuali del fotoperiodo rappresentano il più importante fattore di controllo dell'attività riproduttiva negli uccelli. Obiettivo della ricerca è stato quello di valutare la possibilità di anticipare l'attività riproduttiva in maschi e femmine di Struthio camelus mediante l'utilizzo di Buserelin. Un singolo impianto sottocutaneo a lento rilascio di GnRH analogo ha consentito di indurre l'attività riproduttiva ed ottenere un significativo incremento della produzione annuale di uova.

Parole chiave: *Struzzo, GnRH, Induzione della riproduzione, Produzione uova.*

Introduction

The ostriches (*Struthio camelus*) are large flightless birds native in Africa, raised commercially for their meat, eggs, hide and feathers. The first commercial ostrich farms were established in South Africa around 1860's, after that, ostrich farms began to spread gradually to other countries. In Italy ostrich breeding started at the beginning of 1990, rapidly evolving since then. However, ostrich farming still have some disadvantages; the unsatisfactory rate of productive parameters like fertility and hatching. Most of these problems are correlated with the photoperiodic regulation of seasonal breeding (Sharp, 1996).

Hypothalamic Gonadotrophin Releasing Hormone (GnRH) is the key regulator of reproductive functions in all the vertebrate species. The activities of GnRH neurons are directly affecting GnRH synthesis and/or release, controlled by the biological photoperiodic clock (Yasuo *et al.*, 2003). The major function of this decapeptide is to modulate the synthesis and release of gonadotrophins (FSH, LH) from the pituitary (Schneider *et al.*, 2006).

In female birds, FSH promotes gonadal maturation and follicular selection as well as regulating progesterone secretion by granulosa cells of prehierarchal follicles, LH controls estrogen and androgen production by mature ovarian follicles, induces ovulation and regulates progesterone secretion by granulosa cells (Leska and Dusza, 2007). In males, FSH stimulates gonadal growth and estrogen secretion by Sertoli cells and LH is responsible for androgen production by Leydig cells. Moreover, sex steroids maintain gonadal function, evoke secondary sex characteristics and impinge on sexual behavior (Kirby and Froman, 2000).

Ostrich is a long day breeding bird and the mating season lasts from six to eight months each year, although the timing and duration of breeding can vary with latitude and altitude. In the northern hemisphere, breeding starts during March and ends around August/September, while in the southern hemisphere it begins around July/August and finishes by the end of March.

Male ostriches are polygamous and can mate with more than one female. Domesticated ostriches are kept in pairs (one male and one female) or trios (one male and two females) for the breeding season (Shanawany, 1994). Breeding season is heralded by courtship behaviour and hen starts to lay eggs shortly after mating. Eggs are laid every 1 or 2 day in clutches of 20-24 eggs. The hen stops laying for a period of 7 to 10 days, then she starts a new clutch. The average range is 35 to 55 eggs per hen, but there are high-producing females laying between 50 to 90 eggs in the breeding season.

One of the common purposes of ostrich breeders is increasing the number of eggs produced.

The aim of the current research is to evaluate the use of a slow-release implant of GnRH analogue in order to anticipate the seasonal reproductive activity in male and female.

Material and methods

The study was carried out in an ostrich farm located in South-Italy (northern hemisphere) on 24 adult ostriches (eight males and sixteen females) African Black (4±1.4 years of age) from January to September 2008. The ostriches were divided into 2 groups: group A (treatment) and group B (control), each group composed of 4 trios. The trios were housed in separately pens (5000 m^2) and exposed to natural photoperiod. Ostriches were fed with a self-prepared mash, supplemented with 1kg/bird/d of a pelleted commercial feed, and fresh water *ad libitum*.

In the first week of January, the males

(103±9.2 kg bw) of group A received a single subcutaneous implant of 2.2 mg Buserelin acetate (Suprefact®, Aventis Pharma, Italy), a Gonadotrophin-releasing hormone analogue, adsorbed in 13.2 ml biocompatible silicone (Bayer®, Italy). After 7 days, the females (87±5.5 kg bw) of group A were received a single subcutaneous implant of 2 mg GnRH analogue, adsorbed in 10.8 ml biocompatible silicone. The ostriches of group B were treated in the same days of group A with a single subcutaneous implant contain only biocompatible silicone (13.2 ml/bird for males; 10.8 ml/bird for females). The implants were injected into the dorsal region with a 14Gx3/4"needle.

The trios were daily monitored for sexual behavior and for the eggs deposition in order to calculate laying rates and to compare it with past year's production. Obtained data were analyzed with ANOVA test and the difference considered significant for $P<0.05$.

Results and discussion

In all treated ostriches of groups A and B the subcutaneous implant was completely reabsorbed after few days and no injection-site reaction or adverse drug reaction was observed.

Seven days (±2.8) after treatment, male ostriches of group A exhibited the courtship behavior (coltish, flap wings backwards and forwards, thudding sounds) with typical red colour on the skin of beak and shin. The females of group A showed the typical sexual behavior (crouching, hold wings horizontally, beak opening and closing) 5 days (±3.2) after treatment being mated during night hours. The hens started laying 12 days (±4.5) after treatment and they produced 1 egg every 2 days for 39 days (±4.9), with a stop period of 10 days (±2.8), then a new clutch started. Annual egg production, the number of annual clutches and eggs per clutch of group A during observed period (January-September) are reported in Table 1.

Significant differences in annual egg production (714 *vs* 497; $P<0.05$) and mean clutch number (4.5 *vs* 3.1; $P<0.05$) compared with past year's production were observed in group A.

The hens of group B started laying 35 to 42 days after group A. Annual egg produc-

Table 1. Eggs production rates of group A (treatment) during observed period.

Trio	Hen	No. Clutches		Eggs/clutch (ms ± SD)		Eggs/hen		Eggs/trio	
		2007	2008	2007	2008	2007	2008	2007	2008
1_A	$H_{1.1}$	4	5	21.0 ± 1.4	20.4 ± 1.8	84	102	165	199
	$H_{1.2}$	4	5	20.2 ±1.2	19.4 ± 2.1	81	97		
2_A	$H_{2.1}$	2	3	21.0 ± 1.4	21.6 ± 1.5	42	65	102	147
	$H_{2.2}$	3	4	20.0 ± 2.0	20.5 ± 1.9	60	82		
3_A	$H_{3.1}$	3	5	18.6 ± 1.6	18.8 ± 2.2	56	94	132	190
	$H_{3.2}$	4	5	19.0 ± 2.5	19.2 ± 2.3	76	96		
4_A	$H_{4.1}$	2	4	20.0 ± 2.8	20.0 ± 1.6	40	80	98	178
	$H_{4.2}$	3	5	19.3 ± 3.0	19.6 ± 2.6	58	98		
Total		25	36			497	714		

Table 2. Eggs production rates of group B (control) during observed period.

Trio	Hen	No. Clutches		Eggs/clutch (ms ± SD)		Eggs/hen		Eggs/trio	
		2007	2008	2007	2008	2007	2008	2007	2008
1_B	$H_{1.1}$	3	3	20.7 ± 1.5	19.7 ± 1.1	62	59	143	141
	$H_{1.2}$	4	4	20.2 ± 1.2	20.5 ± 1.3	81	82		
2_B	$H_{2.1}$	2	2	20.5 ± 0.7	20.5 ± 0.7	41	41	101	99
	$H_{2.2}$	3	3	20.2 ± 2.6	19.3 ± 1.6	60	58		
3_B	$H_{3.1}$	3	4	18.7 ± 1.5	19.3 ± 1.0	56	77	114	136
	$H_{3.2}$	3	3	19.3 ± 2.0	19.7 ± 1.5	58	59		
4_B	$H_{4.1}$	2	3	20.5 ± 1.0	20.7 ± 1.2	41	62	118	136
	$H_{4.2}$	4	4	19.2 ± 1.7	18.5 ± 1.3	77	74		
Total		24	26			476	512		

tion, the number of annual clutches and eggs per clutch of group B during observed period (January-September) are reported in Table 2.

In the group B annual egg production (512 *vs* 714; $P<0.05$) and mean clutch number (3.3 *vs* 4.5; $P<0.05$) during observed period were below compared with group A; no significant differences were observed in number of eggs for clutch between the groups.

Conclusions

In African Black ostriches the annual reproduction is directly inhibited due to the short photoperiod and directly stimulated by the long photoperiod, effects being mediated by secretions of GnRH, FSH, LH. This new treatment with a single administration of a slow-release GnRH analogue is a valid method for anticipating the seasonal reproduction in male and female ostrich and can be used without collateral effects for increasing the annual egg production rates.

The paper must be attributed equally to the authors.

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