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Effect of pheasant breeders management on eggs' fertility

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RIASSUNTO – Effetto della gestione dei fagiani riproduttori sulla fertilità delle uova. *Il fagiano (Phasianus colchicus) è in Italia l'animale maggiormente allevato per la caccia. I riproduttori di fagiano vengono allevati in maggioranza utilizzando il sistema con batterie di gabbie a più piani sovrapposti. Ogni gabbia contiene un gruppo di femmine ed un solo maschio. Queste strutture assicurano un miglior management e buoni livelli igienici per l'uovo da cova. Nell'allevamento avicolo in genere il rapporto numerico maschi/femmine riveste un ruolo importante nel determinare la fertilità. Lo scopo della ricerca è quello di valutare l'effetto del maschio di fagiano e delle caratteristiche strutturali dell'allevamento sulla fertilità a fine stagione riproduttiva. I risultati statisticamente significativi ottenuti dall'elaborazione dei dati confermano l'importanza del maschio e dei parametri ambientali nel determinare l'efficienza riproduttiva nel fagiano da caccia. La percentuale media di uova chiare per maschio sul totale delle uova varia tra il 2,15 e il 67,42%. Le gabbie posizionate vicino al suolo (piano 1) sono caratterizzate da una migliore produzione di uova rispetto alle gabbie dei piani 2 e 3: le medie delle uova deposte per femmina sono al primo piano 2,39, al secondo 1,48 ed al terzo 0,80. L'efficienza riproduttiva della specie presa in esame risulta significativamente influenzate sia dalla capacità fecondante del maschio che dalle caratteristiche strutturali e gestionali dell'allevamento.*

Key words: pheasant, egg, fertility.

INTRODUCTION – The pheasant is the most common game bird in Italian countryside. The Italian pheasants' population can be considered as the result of different sub-species hybridisation (Cocchi *et al.*, 2000). The evolution of pheasant farming methods has led to house breeding colonies in single family (1 male with 5-7 females) battery cages (Meriggi, 1992). The traditional housing facilities for breeding colonies were outdoor pens with a covered area, in the same pen different families were housed (Manetti, 1987). In outdoor pens eggs are laid on the floor where biological hazard is high. In recent times, to limit risks and to better general husbandry conditions, the main part of pheasant farms converted breeding facilities into cage systems. In cages facilities higher levels of adaptation are required of birds, anyway birds' husbandry is more accurate, available space is better managed and environmental factors can be better taken under control. The laying period length is an important aspect in captive and domestic birds reproduction highly affecting the number of laid eggs per hen. Different authors report different lengths of laying period 10, 19, 25 weeks depending on geographical localisation, diets and reproduction facilities characteristics and management (Gonzales *et al.*, 1997; Deaming and Wadland, 2001; Mantovani *et al.*, 1993).

The stronger influence of the male compared to females in determining flock fertility, in the main part of domestic avian species, is caused by sex ratio. (Wilson *et al.*, 1979).

The aim of this research was to evaluate the effect of male pheasants and housing on eggs fertility at candling in the last four weeks of the laying period.

MATERIAL AND METHODS – Eighteen cages (120 cm L, 200 cm W, 60 cm H) were randomly sampled in the facility composed by four rows of outdoor battery cages (three floors) in a game bird farm in northern Italy. One single family was housed per cage. Sex ratio was 1:5÷8 male:female (1:5 - 11.11%; 1:7 - 16.67%; 1:8 - 72.22%).

The birds were one year old and belonged to the same genetic strain. A standard breeders diet was fed (22% C.P., 3% Lipids 11.86 Mj M.E. Kg⁻¹).

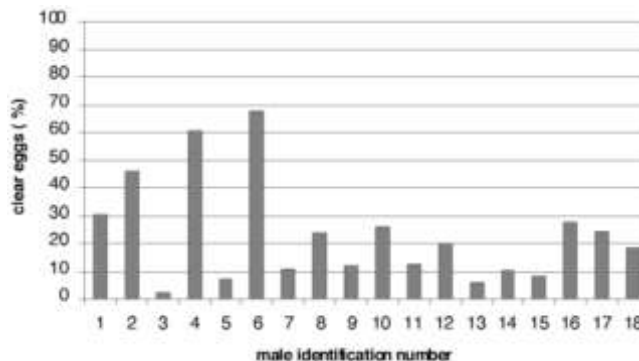
Eggs were daily collected (five days per week) stored in the farm storing room for 1-11 days before incubation. Eggs of every setting were candled at ten days of incubation. Clear eggs were removed and opened immediately after candling. Opened eggs were classified according to their embryonic development as: infertile, germinal disc, dead embryo.

Statistical analyses were performed by the analysis of variance (ANOVA) using General Linear Model procedure of SAS[®] statistic package (SAS, 1998). Independent variables were cage-male bird, cage floor, cage row, week of sampling and pre-incubation storage period (>10d, <10d). Student's t-test was applied to the calculations of the least square means difference.

RESULTS AND CONCLUSIONS – Statistical analysis results show the significant ($P<0.001$) effect of the cage location on the total number of eggs per cage in the four week period. High variability characterises the means of laid eggs ranging from 2.77 to 25.27 eggs per cage, the variable number of females per cage must be taken into consideration. The mortality rate during the research period was 0% so the number of pheasant hens per cage was constant during the whole analysed period. The effect of the cage location on eggs laid per hen is highly significant ($P<0.001$) the values range between 0.39 and 3.15 eggs/hen, ethological characteristic and particularly social behaviour could be considered a key point in family formation to obtain better productions.

The effect of sex ratio on eggs fertility is significant ($P<0.01$), the average percentage of clear eggs on the total number of laid eggs per cage ranges from 2.15 to 67.42%; these values underline the occurring differences within breeder males reproductive efficiency (Figure 1).

Figure 1. Percentage of clear eggs on total eggs produced per cage, effect of male pheasant



Focusing on environmental aspects, cage localisation is important in determining eggs production: the cage floor level has a highly significant ($P<0.001$) effect on the total number of eggs produced per cage and on the number of eggs laid per hen. Eggs production is better on the first floor (closer to ground, total 19.15; eggs/hen 2.39) when compared to production of hens housed on the second (10.55; 1.48) and third (5.77; 0.80) floor. Cage row has a significant effect on eggs production parameters and on eggs reproductive quality parameters: aver-

age total number of laid eggs varies within rows (1-7.64, 2-16.43, 3-10.68, 4-12.52), the number of eggs laid per hen varies according to the total number of eggs produced in each one of the four rows with the lowest value calculated for the first row (1.02) differing very significantly from the number of eggs per hen of the other three rows (2.09, 1.55, 1.56).

The percentage of eggs rejected after candling and the percentage of clear eggs within the eliminated ones are significantly affected by cage row: eggs from the first row are characterised by a higher number of elimination compared to the eggs of the other rows.

The first row has the highest value of clear eggs percentage (35.63) differing significantly ($P < 0.01$) from the percentages calculated for rows two and three. Once again ethological characteristics of game birds must be taken into consideration: row 1 was closer to other farm pens with the presence of birds and human beings than row four that was close to a forest area, row two and three were in the middle so it is possible to suppose a quieter environment.

The week of laying is a basic factor to consider when analysing domestic birds reproduction parameters. The decreasing trend of egg production at the end of the reproduction period has been confirmed in this research. Storage time before incubation when lasting more than 10 days significantly affect the number of rejected eggs and within these the number of eggs with the germinal disc may be due to high environmental temperature, the longer storage time is linked to increasing number of rejected eggs at candling and increasing number of rejected eggs with germinal disc. The occurring differences in both the affected parameters are highly significant. It is important to underline the trends of clear eggs and rejected eggs in the four weeks period. The percentage of clear eggs has a very slightly increasing trend very close to constancy; on the other hand the percentage of rejected eggs has a positive trend. Husbandry (storage time) had a strong influence on these results, particularly on the increasing number of fertile eggs rejected at candling.

The reported results underline the importance of birds and housing facilities in game bird pheasant reproduction. The effect of sex ratio on the fertility of the egg in a critical period (end of laying period) has been demonstrated. Game birds production is characterised by lack of homogeneity in production systems, housing facilities and husbandry, furthermore behavioural characteristics of game birds make them particularly sensitive to environmental stressors, further investigations are needed to determine standard game bird production guidelines taking into consideration birds welfare, management and production economics.

Male pheasant fertility heavily affects the reproductive season efficiency. Candling should be considered a powerful procedure to assess eggs fertility in game birds facilities. High quality of male breeders plays a key role in game birds selection and production. The relatively high number of eggs produced per hen and the number of hens per family are multiplying factors of cock fertility effect. Diet modification could also be considered a successful method to better semen quality particularly when breeders are in a stressful period.

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