Animal Reproduction Science 137 (2013) 214–219

Contents lists available at SciVerse ScienceDirect

Animal Reproduction Science

journal homepage: www.elsevier.com/locate/anireprosci

Egg related parameters affecting fertility and hatchability in the Italian bantam breed *Mericanel della Brianza*

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ARTICLE INFO

Article history:
Received 15 March 2012
Received in revised form
14 December 2012
Accepted 3 January 2013
Available online 12 January 2013

Keywords:
Local chicken breed
Bantam breed
Egg parameters
Hatchability

ABSTRACT

Local chicken breeds are a vital reservoir of gene resources and their conservation has a technical role related to the future development of the productive system, as well as a social-cultural role. The aim of this study was to evaluate the effects of egg weight, egg storage period and egg weight loss on hatchability of fertile eggs in the Italian bantam breed *Mericanel della Brianza*. Fourteen females and eight males were kept in floor pens and divided in 8 families (1M:1 or 2F) during the reproductive season (March–June). Birds received a photoperiod of 14L:10D and were fed *ad libitum*. Egg production and egg weight were recorded daily. Eggs were divided in 4 weight groups: EW1 = <33 g, EW2 = 33–36 g, EW3 = 36–39 g and EW4 = ≥39 g. Eggs were stored at 18 °C and classified in 3 egg storage groups: ES1 = 0–4, ES2 = 5–9 and ES3 = 10–15 days. Egg weight loss was recorded and distributed in 5 different classes: EWL1 = <10%, EWL2 = 10–15%, EWL3 = 16–20%, EWL4 = 21–25%, EWL5 = >25%. Fertility, embryo mortality and hatchability were recorded. The mean values during the reproductive season were 82% fertility and 50% hatchability of fertile eggs. The best combination of fertility and hatchability values were recorded in EW2 and lower fertility was recorded in EW1 ($P < 0.05$). Hatchability decreased under 50% after 10 day storage period before incubation and the best hatchability was recorded in EWL1. The present results contribute to the knowledge on reproductive parameters necessary to improve the reproductive efficiency of this Italian breed within a conservation plan.

1. Introduction

Livestock breeds are recognized as important components of world biodiversity because the genes and gene combinations they carry may be useful to agriculture in the future (IUCN, 1980). Specific breeds may possess great adaptability to different environmental challenges and livestock genetic conservation measures are, therefore, likely to remain focused on the maintenance of breeds. The major threat to rare and minority breeds is absorption into breeds with larger numbers of animals, usually by repeated use of males from the breed that is under threat because of small animal numbers (Bradley et al., 1994). Accordingly, the basic principle of breed conservation is the promotion of pure breeding (Stephen and Bradley Daniel, 1995). The development of a conservation program includes different activities: improvement on the knowledge of biological functions, conservation of typical morphological characteristics, development of selection strategies, control of inbreeding and, strategies for enhancing financial well-being through diffusion of the breed in local productive systems (Zanon and Sabbioni, 2001). In Italy, few conservation programs for avian breeds are in progress with the support of local institutions because their consistency today is dramatically decreased. With a broad literature

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http://dx.doi.org/10.1016/j.anireprosci.2013.01.002

search, 90 Italian avian breeds were described, classified and dated from the last century. The majority of the breeds (61%) were classified as extinct, 13% as threatened, 17% as poorly diffused and only 8.9% as still widely spread (Zanon and Sabbioni, 2001). It is clear that efforts for conservation of Italian avian breeds are urgently required, in particular for local chicken breeds that are good prospects for environmental adaptability and disease resistance as a vital reservoir of gene resources. Many factors such as desirable fertility and hatchability affect breeding program success. According to Meir and Ar (2008), it is well accepted that water loss through the shell during artificial incubation is one of the key factors that affects hatching success. Additionally, storage of hatching eggs is a necessary part of commercial incubation, even though storage length and conditions may influence post-ovipositional mortality of embryos (Lapão et al., 1999). Furthermore, the effects of age and egg size (egg weight) on production parameters have been studied (Wilson, 1991; Ulmer-Franco et al., 2010).

Preservation of local avian breeds plays an important role in safeguarding of animal biodiversity; it could have a relevant role in developing new high quality products for niche markets and also represents an important tool to preserve and support the rural economy in some marginal agricultural areas. The aim of the present study was to record the reproductive performance in a small population of *Mericanel della Brianza* (MdB) chickens. MdB is the unique Italian bantam breed with an official standard (FIAV, 1996) and was historically present in rural areas of the Lombardia region (North Italy). The standard of the breed explains the morphological characteristics typical of these poultry but no data are available on reproductive performance and growth parameters. In the present study, reproductive parameters have been recorded during the breeding season and different egg parameters known to be related to hatchability were studied. Egg weight, days of egg storage before incubation and decrease of egg weight during incubation were recorded and the effect on hatchability was studied.

2. Materials and methods

Chicken breeders of the Italian bantam breed *Mericanel della Brianza* were used. Fourteen females and eight males were available at the beginning of the reproductive season on March and housed in a controlled environment at the Poultry Unit, Animal Production Centre, University of Milan (Lodi, Italy). All birds, aged from 24 to 36 weeks, had white plumage and were acquired over a few reproductive seasons from a local breeder. The birds were divided into eight families, one male and one or two females from each family, and kept in floor pens (1 m × 3 m) under natural mating conditions. Birds received a photoperiod of 14L:10D and were fed *ad libitum* a standard commercial diet for chicken breeding flocks (2800 kcal ME/kg, 15% crude protein, 3% ether extract, 10.5% ash, 3.10% calcium). Egg production was recorded daily in each pen from March to June and the proportion of eggs/hen was calculated per week. Eggs were weighed, labeled with the date of oviposition and stored at 18 °C in an isolation room until setting, relative humidity (RH) was 70%. Egg storage was up to 15 days maximum to test the effect of egg storage on hatchability. Eggs were set every 2 weeks from March to May. Standard incubation parameters for hen eggs were used (Romboli and Marzoni, 2008). From Day 1 to 18 (Day 0 = first day of incubation), incubation temperature was 37.7 °C, RH was 55% and eggs were automatically turned (incubator model 11FH, capacity 702 eggs, Maino, I). From Day 19 to 21, eggs were transferred into the hatcher (incubator model 1350XH, capacity 350 eggs, Maino, I) and kept at 37.2 °C and 80% RH. A total of six consecutive settings were performed with a total of 387 eggs. The number of eggs incubated for each setting was 71 in Setting 1, 40 in Setting 2, 79 in Setting 3, 58 in Setting 4, 57 in Setting 5 and 82 in Setting 6.

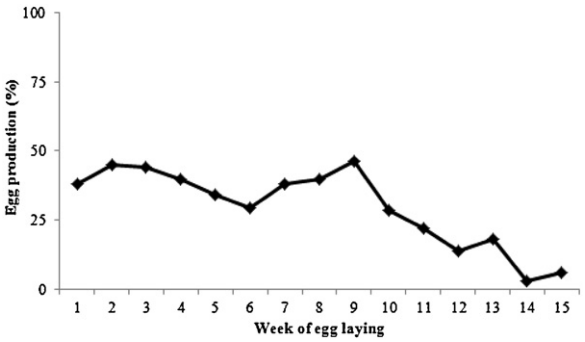

Fig. 1. Egg production recorded weekly from March to June in *Mericanel della Brianza* hens.

Fertility and early embryo mortality were recorded on the seventh day of incubation by candling, clear eggs and dead embryos were discarded. Clear eggs were opened to assess fertility and very early embryo mortality occurring within 48 h incubation was recorded. Fertility (%) was calculated on total settings. Egg weight was recorded on Day 18 before transfer into the hatcher and egg weight loss (EWL) during incubation was calculated. Hatchability was recorded and eggs for which there was no hatching were opened to record late embryo mortality. Hatchability and embryo mortality were calculated on fertile eggs. Embryo mortality was also grouped in classes according to the development of dead embryos and data have been presented and discussed in a previous paper (Cerolini et al., 2010).

Descriptive statistical parameters were calculated for egg weight, EWL, fertility, hatchability and embryo mortality. Egg weight was classified in four groups: EW1 = <33 g, EW2 = 33–36 g, EW3 = 36–39 g and EW4 = ≥39 g. Egg storage was classified in three groups: ES1 = 0–4 days, ES2 = 5–9 days and ES3 = 10–15 days. EWL was distributed in five different classes: EWL1 = <10%, EWL2 = 10–15%, EWL3 = 16–20%, EWL4 = 21–25%, EWL5 = >25%. Data on fertility, embryo mortality and hatchability were analyzed using the χ^2 test to determine results diverging from the null hypothesis; egg weight, egg storage and EWL classes were considered as frequency categories (SAS, 1999).

3. Results

Mean egg production recorded weekly during the reproductive period is reported in Fig. 1. Egg production was high