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The possibility of obtaining intergeneric hybrids via White Kołuda (*Anser anser* L.) goose insemination with fresh and frozen-thawed Canada goose (*Branta canadensis* L.) gander semen

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Abstract

The objective of the present experiments was to produce the intergeneric hybrids of domesticated and wild goose via artificial insemination with fresh and frozen-thawed semen. The experiments were carried out during two successive goose reproductive seasons, on eight five-year-old Canada Goose (*Branta canadensis* L.) males used as semen donors and 16 two-year-old White Kołuda geese designated to fertility tests. Pooled semen was collected twice a week by the dorso-abdominal massage. In freshly collected semen, ejaculate volume, color, consistency, degree of fecal or blood contamination, spermatozoa concentration, motility, and morphology were evaluated. Part of the semen collected in the first year of the experiment (Experiment 1) was used for geese insemination with fresh semen, while the remainder was frozen. In Experiment 2 all samples were subjected exclusively to freezing procedure. Geese were inseminated once a week with fresh semen in a dose of 80 μl or 160 μl, and twice a week with frozen-thawed semen in a dose of 80 μl (160 μl per wk) or 100 μl (200 μl per wk). Eggs were set weekly and incubated up to hatching.

The volume of ejaculates varied from 0.100 to 0.470 ml; spermatozoa concentration from 140 to 310 million ml^{-1}; progressive movement was observed in 40 to 60% of spermatozoa; the percentage of total live spermatozoa ranged from 69.3 to 92.0%, the highest percentage (34.0–68.3) was represented by live normal spermatozoa and those with bulb-head (13.3–41.0). Cryopreservation caused a decrease in percentage of motile cells to 30%; total live spermatozoa contribution by 27.2%p, including those live normal by 15.9%p (in relation to the fresh semen), bulb-head spermatozoa by 10.9%p, and increase (by 5.9%p) in number of spermatozoa with other deformations. Goose insemination 1×/week with fresh semen containing about 10.3 million live normal spermatozoa resulted in 66.7% of fertile eggs and with dose higher by 2.8 million spermatozoa (on average) the fertility increased by 20.9%p (up to 87.6% on average). Hatchability from set and fertile eggs was 55.9% and 83.9% vs. 66.3% and 75.6%, respectively. After twice a week insemination with frozen-thawed semen containing about 10.2 million live normal cells 58.2% eggs were fertile; hatchability from set eggs was 42.8% and from fertile eggs 71.7%, while insemination dose increase by 2.7 million spermatozoa per week caused a fertilization increase by 3.8%p (62.0% on average), this increase was not statistically significant, but hatchability from the fertile eggs (95.4%), was significantly ($P < 0.05$) higher.

The use of AI with fresh semen in the creation of intergeneric hybrids of Canada goose males and White Kołuda females allows a high level of egg fertility to be obtained. Furthermore, one limitation which is the short reproductive season of the Canada goose may be overcome by the use of cryopreserved semen.

Keywords: Geese; Intergeneric crossing; Artificial insemination; Fertility; Semen; Cryopreservation

1. Introduction

Intergeneric hybrids of different poultry species (chicken, turkey, guinea fowl, Japanese quails, pheasant, common and Muscovy ducks) [1] are created

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mainly to improve the slaughter value [2] and meat quality of poultry species [3–8]. However, in poultry production the mule ducks obtained by crossing Muscovy drakes (*Cairina moschata* L.) and common duck females (*Anas platyrhynchos* L.) are the most popular intergeneric hybrids [9]. They are used for both meat and fatty liver production. In nature, the avian hybrids also occur [10–11]. In poultry practice, because the rate of egg fertilization obtained after natural mating is much lower when compared with artificial insemination [12–13], the reproductive performance of this crossbreeding has significantly improved over recent years owing to the extensive use of AI [14].

Our previous studies suggest the possibility of improving the meat quality and slaughter yield of the domestic goose by introducing the genes of the Graylag goose (*Anser anser* L.) [5], Canadian goose (*Branta canadensis* L.) [7] or geese from genetic reserve flocks [6].

Feral populations of Canada goose (*Branta canadensis* L.) are large and the growing feral populations in Europe and non-migratory populations in North America are beginning to conflict with human interests [15]. High abundance of Canada geese and the ability to maintain them in captivity can be used in crossing with domesticated goose breeds. Pilot experiments carried out by the authors showed that the use of Canada goose as a component for crossing with White Kołuda goose resulted in progeny with a carcass characterized by a high proportion of breast muscles and total muscles, low skin weight with subcutaneous fat, and a lower proportion of abdominal fat [7].

Apart from its low quantitative and qualitative semen traits, the greatest problem concerning wild goose reproduction in captivity that in consequence limits the production of wild and domestic goose hybrids on a commercial scale is the very short reproductive cycle of the wild goose [16]. In the Graylag goose it lasts about 6 wks (from the middle of March to the end of April) [17] and 8 to 9 wks in the Canada goose [18–19], while in the domesticated goose it is nearly 6 mo (from January to the middle of June) [20]. The usefulness of wild goose semen in crossbreeding can be prolonged by application of cryopreserved semen. This allows this physiological barrier to be circumvented and a higher number of chicks to be obtained during the longer reproductive cycle of the domesticated goose breeds. However, the fertilizing potency of thawed semen is usually significantly decreased. Chrzanowska and Chełmońska [17] using AI with fresh semen in crossing Graylag gander with White Kołuda goose reported egg fertility at 76.7%, while using frozen-thawed semen only 25.0% fertilization was obtained [16].

The objective of the present experiments was to examine the reproductive parameters of the White Kołuda goose after insemination with fresh and frozen-thawed Canada (*Branta canadensis* L.) gander semen.

2. Materials and methods

2.1. Birds

The experiments were carried out at the Division of Poultry Breeding, Wrocław University of Environmental and Life Sciences during two successive goose reproductive cycles (Experiment 1-2). In every season eight Canada goose (*Branta canadensis* L.) males used as semen donors were housed on a deep litter in an open-air pen (3 × 10 m) and with a water basin. Except for days when semen collection was performed, during the day males also had free access to a green field. At the onset of the experiment males were aged five years. Sixteen two-year-old White Kołuda geese subjected to the fertility tests were randomly divided into two groups and kept in two separate pens (3 × 10 m).

All birds were housed under natural light and temperature conditions. Commercial feed for reproductive goose and water were provided *ad libitum*. The mixture contained 11.1 MJ of metabolize energy and 140 g of crude protein per kilogram.

2.2. Semen collection and determination of semen quality

In both seasons, about three wks before semen collection, all ganders were trained for handling, massage and the attempt to obtain an ejaculate. Pooled semen was collected twice a week by the dorso-abdominal massage, from the beginning of March till the middle of May. To maximize semen quality and quantity, the collection was always performed under the same conditions (persons, time, and massage procedure). Single ejaculates were visually examined during collection and those of good quality (free of fecal matter or blood) were transferred with an automatic pipette into a glass tube, and one uniformed semen sample was created. The average time of semen collection from one male lasted 2 min.

Every freshly collected semen sample was evaluated using both macroscopic (volume, color, consistency, degree of contamination) and microscopic (spermatozoa concentration, motility and morphology) criteria. Motility and morphology were also evaluated in frozen-