Research progress on growth curve fitting analysis of goose

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Abstract. Based on the mathematical description and biological parameters of three nonlinear growth models (Logistic, Gompertz, Bertalanffy), the recent advance of growth curve fitting analysis in goose have been reviewed briefly in this paper in order to provide some basic information for future goose research and breeding work.

Keywords: Goose, Growth curve, Fitting analysis.

1 Introduction

The growth curve reflecting the regular changes of growth and development to ensure the best economic benefits in biological individuals has been widely used to describe the growth process in poultry, especially in goose[1-4]. The fitting analysis of the growth curve can dynamically understand the process of goose growth, guide the feeding and management, improve the efficiency of breeding. In recent decades, several mathematical models have been constructed to describe the growth curve of goose. Three nonlinear growth models (Logistic, Gompertz, Bertalanffy) are most commonly been used (Table 1)[5]. In this paper, we briefly reviewed the recent advance of growth curve fitting analysis in goose, and aimed to provide some basic information for future goose research and breeding work.

2 Growth curve fitting analysis in goose

In this paper, the growth curve fitting analysis covered 22 goose species including gender (male or female), sample collection and other factors (Table 2). From Table 2, we can see that Logistic model accounted for a great proportion of the total growth model. The average fitting degree is 0.995, the average inflexion age is 5.63w, the average inflexion weight is

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2003.53g, and the average maximum weight gain a week is 969.92g. Gompertz model accounted for the second great proportion of the total growth model. The average fitting degree is 0.999, the average inflexion age is 4.23w, the average inflexion weight is 1575.69g, and the average maximum weight gain a week is 499.37g. The least proportion of the total growth model is Bertallanffy model. The average fitting degree is 0.992, the average inflexion age is 7.74w, the average inflexion weight is 1528.41g, and the average maximum weight gain a week is 266.52g.

Table 1. Mathematical description and biological parameters of three common used nonlinear growth models.

Model	Expression	Inflection weight	Inflection age	Maximum weight gain a week
Logistic	$Y=A/(1+Be^{-kt})$	A/2	(lnB)/K	Kw/2
Gompertz	$Y=Ae^{-bexp(-kt)}$	A/e	(lnB)/K	Kw
Bertalanffy	$Y=A(1-Be^{-kt})^3$	8A/27	(ln3B)/K	3Kw/2

A: limited growth value; k: Transient growth rate; B: Parameter; t: weekly age.

Table 2. Growth curve fitting analysis in goose.

Species	location	Gender	Weeks (w)	Fitness	Best model	Inflection age (w)	Inflection Weight (g)	Maximum weight gain a week (g)
Sichuan White Goose[6]	Sichuan	Unkonwn	0~10	0.999	Gompertz	3.93	1263.66	415.8
Taihu goose[7]	Jiangsu	Half of male and female	1~13	0.999	Gompertz	4.97	1299.67	Unkonwn
Zhejiang White Goose e[9]	Zhejiang	female	0~8	0.999	Gompertz	4.37	1508.50	Unkonwn
Zhejiang White Goose[9]	Zhejiang	Male	0~8	0.999	Gompertz	4.50	1710.71	Unkonwn
Zhejiang White Goose[10]	Zhejiang	Unkonwn	0~10	0.999	Gompertz	4.42	1764.84	Unkonwn
Lande Goose[11]	Hubei	Male	0~10	0.999	Gompertz	3.97	1772.54	Unkonwn
Lande Goose	Hubei	Female	0~10	0.999	Gompertz	3.99	1774.34	Unkonwn
Lande Goose[12]	Shanghai	Unkonwn	0~8	0.999	Gompertz	3.65	1511.29	582.94
Wulong goose[7]	Shangdong	Half of male and female	1~13	0.997	Bertalanffy	7.575	1513.62	Unkonwn
Wanxi White goose[8]	Anhui	Half of male and female	1~13	0.993	Bertalanffy	4.26	1140.98	Unkonwn
Sichuan White Goose[6]	Sichuan	Half of male and female	1~13	0.983	Bertalanffy	5.05	1343.81	Unkown
Magang Goose[13]	Guangdong	Half of male and female	1~18	0.995	Bertallanffy	14.07	2115.22	266.52
Sanhua goose[7]	Jiangsu	Half of male and female	1~13	0.995	Logistic	8.95	2037.49	Unkonwn

Shitou Goose[14]	Guangdong	Male	0~12	0.999	Logistic	7.50	3386.15	Unkonwn
Shitou Goose	Guangdong	Female	0~12	0.999	Logistic	7.20	2995.10	Unkonwn
Xiang White Goose[15]	Unkown	Male	0~12	0.990	Logistic	5.20	2055.85	Unkonwn
Xiang White Goose[16]	Unkown	Female	0~12	0.988	Logistic	5.00	1876.45	Unkown
Zhejiang White Goose[16]	Zhejiang	Unkonwn	0~13	0.999	Logistic	5.34	1758.17	969.82
Wanxi White Goose[8]	Jiangsu	Male	0~10	0.994	Logistic	4.30	1701.4	Unkonwn
Wanxi White Goose[8]	Jiangsu	Female	0~10	0.998	Logistic	4.10	1440.3	Unkonwn
Sichuan White Goose[6]	Jiangsu	Male	0~10	0.995	Logistic	4.40	1462.7	Unkonwn
Sichuan White Goose[6]	Jiangsu	Female	0~10	0.997	Logistic	4.30	1321.7	Unkonwn

From the above mentioned analysis of the goose growth curve in the last 10 years, we can see that not only the different breeds of goose will lead to different growth models, but also the optimum growth model of the same breed of goose. There are three articles of Sichuan White Goose in all. However, the best model supported by each literature are not the same, respectively. The Gompertz model (Liu Zuolang, 2017)[6]; Bertalanffy model (tang qingping, 2010)[7] and Logistic model (Wangjian, 2014)[8].

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