

Breeding of new silkworm variety, 'Chilseongjam' with peculiar laval mark

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Abstract

A new silkworm variety 'Chilseongjam' was bred for special purpose as educational learning and festivals. Their breeding history and major characteristics are as follows. The Chilseongjam variety was selected and succeeded from the F1 of Galwon x C721 in 2009 autumn. They are showing 94% (spring & autumn) of high practical hatching ratio. The larval period of Chilseongjam (spring: 23 d, autumn: 24 d 3 h) was shorter than that of Daebakjam (spring: 24 d, autumn: 25 d 23 h). In the pupation percentage, Chilseongjam (spring: 96.6%, autumn: 86.1%) is similar to Daebakjam (spring: 96.3%) in spring, but autumn is lower than Daebakjam (autumn: 94.9%). Single cocoon weight (spring: 1.57 g, autumn: 1.29 g) and Cocoon yield (spring: 14.2 kg, autumn: 11.1 kg) were lower than those of Daebakjam (spring: 2.76 g, 25.4 kg, autumn: 2.19g, 20.2 kg), respectively. The new silkworm variety, Chilseongjam showed higher pupation rate than control variety. This variety can be used as an educational learning and festivals.

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Int. J. Indust. Entomol. 37(2), 69-72 (2018)

Received : 3 Nov. 2018
Revised : 10 Dec. 2018
Accepted : 13 Dec. 2018

Keywords:

Silkworm,
Breeding,
Laval mark,
Special purpose

Introduction

Silkworms (*Bombyx mori*) are well-known industrial insects, which produce natural fiber silk. Because of economic importance for silk yarn, an effort to breed new silkworm variety has been made for thousand years (Kang *et al.*, 2003). The Korean sericulture has been well adapted to the current situations and requests by supplying many kinds of silkworm varieties to the sericulture farms since the beginning of sericultural research in 1900 (Lee *et al.*, 1985). Recently, the purpose of silkworm breeding has been changed to meet novel requirement for functional sericultural products such as silkworm powder, male pupae, and educational learning and festivals (Kang *et*

al., 2010). Especially, the demand of silkworm varieties for educational learning and festivals has been increased in Korea. The NIAS (National Institute of Agricultural Science) maintains 335 silkworms varieties (Sohn *et al.*, 2001). Some of the silkworm genetic resource has peculiar marks such as striped, spotted and dark, but they have not adaptable to rear in farmer due to unhealthy, bad oviposition, and small cocoon (Harada, 1961). So, the NIAS was bred strains of which characteristics were improved by cross breeding. The first silkworm strains for educational learning and festivals were "Eolrukmal" and "Hukpyobeom" varieties in 2010 (Kang *et al.*, 2010). The Eolrukmal variety has striped larval markings like zebra and spins yellow cocoons. The Hukpyobeom variety has black body

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Table 1. Rearing results of Chilseongjam through the local adaptability test performed at 8 places in spring 2016

Variety	Useful Hatchability (%)	Larval period (days.hrs)		Pupation Percentage (%)	Cocoon yield* (kg)
		5th instar	Total instar		
Daebakjam	96	7.02	24.00	96.3	25.4
Chilseongjam	94	6.02	23.00	96.6	14.2

*Cocoons were produced from 10 thousand of 5 instar larvae

Variety	No. of cocoons per liter(ea)	Single cocoon weight(g)	Cocoon shell percentage(%)	Laval marking	Cocoon color
Daebakjam	40	2.76	23.6	white	white
Chilseongjam	91	1.57	15.4	Seven spots	light Green

color except its segment and it spins yellow cocoons (Kang *et al.*, 2010). We will need new varieties according to the demands of various educational learning and festivals varieties. Therefore, we bred the new silkworm, Chilseongjam with peculiar larval marks for educational learning and festivals.

Here, we report the development of the new variety, Chilseongjam. The variety was bred developed through pure line test, local adaptability and main productivity tests in Korea. In the present report, the major breeding schemes and important characteristics of Chilseongjam are described.

Materials and Methods

Silkworm variety

The chilseongjam variety have seven pairs spots larval marks and spins light green cocoons. This variety was bred in the autumn, 2009 by crossing Galwon and C721 and the individuals with seven pairs spots markings were selected during the first generation (Fig. 1). Figure 1 shows the pedigree of Chilseongjam. From 2009 this variety was succeeded for 10 generations in Department of Agricultural Biology, it was designated as specific larval marking varieties in 2016 leading silkworm variety committee.

Silkworm rearing and cocoon examination

Silkworms were hatched under 15-26°C of temperature and 75~80% of humidity with 16 h light and 8 h dark photoperiod condition. They were reared at 25°C and fed with mulberry leaves and an artificial diet. Silkworms were reared following

Sericultural Experiment Guide as follows; 1st~3rd instar (25-26°C temperature, 75-80% humidity covered with wax paper), 4th~5th instar (23-24°C temperature, 65-75% humidity). Silkworms were fed three times a day with mulberry leaves. Each hybrid groups were consisted of 1,500 silkworms and mounted with rotating mounting frames. Cocoon characteristics examination was conducted 8 d after mounting, pupation rate and 10 thousand cocoon weights were examined. Single cocoon weight, cocoon shell weight, and cocoon shell percentage of male and female were measured respectively and averages were calculated. Characteristics of original strains, artificial diet adaptability and cocoon quality were examined based on Sericultural Experiment Guide (Kang *et al.*, 2000).

Results and Discussion

Silkworm rearing results

Table 1 shows rearing results of Chilseongjam (Galwon x C721) conducted by NIAS and 7 local sericultural experiment stations in 2016 spring for examining its productivity and local adaptability (Fig. 1). Chilseongjam showed 94% practical hatchability which was similar to control Daebakjam. Daebakjam was bred by Kang *et al.* (2012) and showed higher pupation rate and heavier cocoon yields. Pupation ratio of Chilseongjam (96.6%) was similar to that of control (96.3%). Cocoon yield is evaluated as 10 thousand cocoon weight. The 10 thousand cocoon weight (14.2 kg) was lower than Daebakjam (25.4 kg). Hatchability is an economic indicator for silkworm culture. Hatchability (94%) and pupation percentage (96.6%) of Chilseongjam were more than 90%. However, cocoon yield

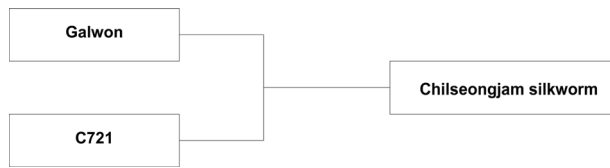


Fig. 1. The pedigree of ‘Chilseongjam silkworm’, the F1 hybrid between Galwon × C721.

of Chilseongjam was lower than that of commercial silkworm variety, Daebakjam due to smaller cocoon size and lighter single cocoon weight. The Eolrukmal and Hukpyobeom varieties were also lower than Daebakjam variety.

Table 2 shows rearing results of Chilseongjam conducted by NAIS and 7 local sericultural experiment stations in 2016 autumn, also. Chilseongjam showed 94% practical hatchability lower with control Daebakjam (99%) (Kang *et al.*, 2012). Pupation ratio of Chilseongjam (86.1%) was lower to that of control (94.9). The 10 thousand cocoon weight (11.1 kg) was lower than Daebakjam (20.2 kg). Although cocoon yield and cocoon shell percentage were lower to that of control, hatchability was more than 90%.

Artificial diet adaptability test results

As indicated in Table 3, the results of the adaptability test for artificial diet of young silkworm of Chilseongjam. Kumokjam

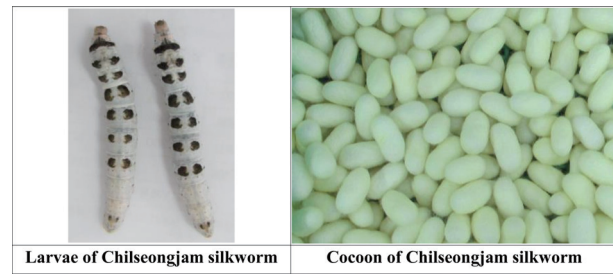


Fig. 2. Photographs of larvae and cocoons of the Chilseongjam silkworm

is a typical artificial diet silkworm variety in Korea (Hong *et al.*, 1996). The artificial diet adaptability was examined based on Sericultural Experiment Guide (Kang *et al.*, 2000). In the experimental results, bristling percentage of Chilseongjam (80%) was lower than that of Kumokjam (96%). Larval period from 1st to 3rd of Chilseongjam (12.09 d) and Kumokjam (12.09 d) was the same. Molting percentage of Chilseongjam was nearly over 90%, although it is a littler lower than that of Kumokjam. The effect of artificial diet on the larval period and molting percentage reveals that Chilseongjam is evaluated as low artificial diet.

In conclusion, although a new silkworm variety, Chilseongjam showed lower breeding test results than control variety, it has excellent hatchability and a special larval pattern. Also, This variety can be used as a educational learning and festivals.

Table 2. Rearing results of Chilseongjam through the local adaptability test performed at 8 places in autumn 2016

Variety	Useful Hatchability(%)	Larval period (days.hrs)		Pupation Percentage(%)	Cocoon yield* (kg)
		5th instar	Total instar		
Daebakjam	99	8.00	25.23	94.9	20.2
Chilseongjam	94	6.04	24.03	86.1	11.1

*Cocoons were produced from 10 thousand of 5 instar larvae

Variety	No. of cocoons per liter(ea)	Single cocoon weight(g)	Cocoon shell percentage(%)	Laval marking	Cocoon color
Daebakjam	53	2.19	21.3	white	white
Chilseongjam	109	1.29	15.2	Seven spots	light Green

Table 3. Adaptability test to the artificial diet of silkworm in spring 2016.

Variety	Bristling percentage	Larval period from 1st to 3rd	Molting percentage			Adaptability
			2nd	3rd	4th	
	%	days.hrs	%	%	%	
Kumokjam	96	12.09	99	96	96	Excellent
Chilseongjam	80	12.09	86	93	91	Good

Acknowledgements

We appreciate the staffs of 7 local sericultural experiment stations for their cooperation in breeding of this strain. This study was carried out with the support of "Research Program for Agricultural Science & Technology Development (Project No. PJ01001802)", National Institute of Agricultural Sciences, Rural Development Administration, Republic of Korea.

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