

A new breed of silkworm variety, Juhwangjam, for light pink cocoon

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Abstract

A new silkworm variety, Juhwangjam, was bred for the producing of light pink colored cocoon. The Juhwangjam variety was selected and succeeded from the F1 of 2303 x BP Heehong in 2016 autumn. Hatchability (96%) and pupation percentage (97.6%) of Juhwangjam was matched to the authorization criteria for commercial silkworm variety. Laval period and other economical characters of Juhwangjam were similar to the authorized silkworm variety, Goldensilk. Cocoon yield of Juhwangjam in spring and autumn season was 20.0 and 14.3 kg, respectively. Therefore, a new silkworm variety, Juhwangjam for light pink cocoon, might be adaptable to culture in spring season rather than autumn season.

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Introduction

The sericultral environment has been weakened because of aging, labor shortage and other problems. To overcome these issues, silkworm breeding goal has been focused on strengthening some essential characteristics of silkworm such as healthiness, artificial diet adaptability, and sex-limited etc. But breeding of silkworm variety having good characteristics is very difficult because some practical characteristics have inverse relation with each other. Recently the purpose of silkworm breeding has been changed to breed specific silkworm varieties for silkworm powder, Nuedongchunghacho (*Paecilomyces tenuips*) and male pupae production, and so on.

New developed silkworm varieties are Hanbyeolnue, sex-limited larval marking yellow cocoon, and Chilseongjam,

peculiar larval mark (Kim *et al.*, 2016; Kim *et al.*, 2018). Specific silkworm varieties having unique colored cocoons have been bred by National Institute of Agricultural Sciences (NAS) including Goldensilk (Kang *et al.*, 2007) and Yeonnokjam (Kang *et al.*, 2011). Silkworm variety, Goldensilk, produces bright yellow cocoon, and silkworm variety, Yeonnokjam, produces polish green cocoon. Now a day, we reported a new silkworm variety, Juhwangjam, for producing light pink colored cocoon through cross breeding. The silkworm powder made from Juhwangjam might be used for functional food resources, educational materials, and festival matter.

Juhwangjam was 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 Juhwangjam are described.

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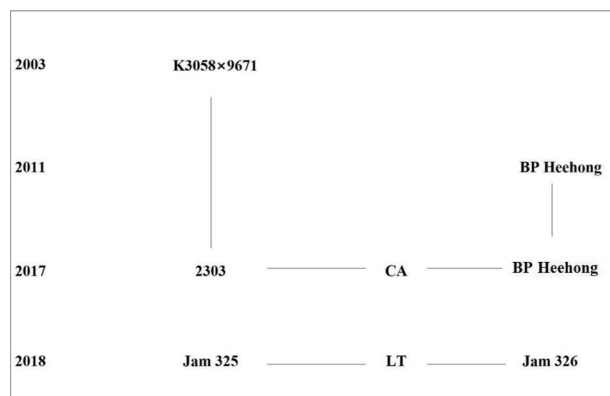


Fig 1. The Pedigree of Juhwangjam silkworm, the F1 hybrid between Jam325 × Jam326. CA : Combining ability test, LT : Local adaptability test

Materials and Methods

Silkworm variety

Juhwangjam was crossbred from strain Jam 325 and strain Jam 326 (Fig. 1). Goldensilk and Kumokjam, bred by NAS RDA for spring season, was used as the control strain.

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.

Rearing performance including useful hatchability, pupation percentage, cocoon yield, number of cocoons per liter, sing cocoon weight, cocoon shell percentage, larval mark, and cocoon color were examined and measured according to the sericultural experiment guide in Korea (Kang *et al.*, 2000). Briefly, cocoon conducted 8 d after mounting was used to examine the important economic characteristics. Single cocoon weight, cocoon shell weight, and cocoon shell percentage of male and female were measured respectively and averages were calculated.

Results and Discussion

Silkworm rearing results

Table 1 shows rearing results of Juhwangjam (2303 x BP Heehong) conducted by NAS and 7 local sericultural experiment stations in 2018 spring for examining its productivity and local adaptability. The larva and cocoon of a new silkworm breed, Juhwangjam was shown in Fig. 2.



Fig 2. Larvae and cocoons of the Juhwangjam silkworm

Table 1. Rearing results of Juhwangjam through the local adaptability test performed at 8 places in spring 2018

Variety	Useful Hatchability (%)	Larval period (days.hrs)		Pupation Percentage (%)	Cocoon yield* (kg)
		5th instar	Total instar		
Goldensilk	94	6.12	23.03	96.2	18.3
Juhwangjam	96	6.10	23.10	97.6	20.0

*Cocoons were produced from 10 thousand of 5 instar larvae

Variety	No. of cocoons per liter	Single cocoon weight (g)	Cocoon shell percentage (%)	Laval marking	Cocoon color
Goldensilk	67	1.93	18.7	Plain	Yellow
Juhwangjam	72	2.09	19.9	Plain	Light pink

Table 2. Rearing results of Juhwangjam through the local adaptability test performed at 8 places in autumn 2018

Variety	Useful Hatchability (%)	Larval period (days.hrs)		Pupation Percentage (%)	Cocoon yield* (kg)
		5th instar	Total instar		
Goldensilk	97	6.12	23.13	92.1	14.6
Juhwangjam	97	6.18	23.21	82.2	14.3

*Cocoons were produced from 10 thousand of 5 instar larvae

Variety	No. of cocoons per liter	Single cocoon weight(g)	Cocoon shell percentage (%)	Laval marking	Cocoon color
Goldensilk	77	1.66	17.8	Plain	Yellow
Juhwangjam	85	1.79	18.3	Plain	Light pink

Table 3. Adaptability test to the artificial diet of silkworm in spring, 2018.

Variety	Bristling percentage	Larval period from 1st to 3rd	Molting percentage			Adaptability
			2nd	3rd	4th	
	%	days.hrs	%	%	%	
Kumokjam	100	9.08	70	100	100	Excellent
Juhwangjam	100	9.08	100	100	95	Excellent

The cocoon color of Juhwangjam and Goldensilk are light pink and yellow, respectively. Juhwangjam showed 96% of useful hatchability which was higher than control Goldensilk. Pupation percentage of Juhwangjam (97.6%) was higher than that of control (96.2%). Cocoon yield is evaluated as 10 thousand cocoon weight. Cocoon yield of Juhwangjam (20.0 kg) was higher than Goldensilk (18.3 kg). Hatchability is an economic indicator for silkworm culture. Hatchability (96%) and pupation percentage (97.6%) of Juhwangjam were more than 90%. Also, cocoon yield of Juhwangjam was lower than that of commercial silkworm variety, Goldensilk.

Table 2 showed rearing results of Juhwangjam conducted by NAS and 7 local sericultural experiment stations in 2018 autumn. Juhwangjam showed 97% practical hatchability (control Goldensilk (99%)). Pupation ratio of Juhwangjam (97.6%) was lower to that of control (94.9). The 10 thousand cocoon weight (14.3 kg) was lower than Goldensilk (14.6 kg). Although cocoon yield and cocoon shell percentage were lower to that of control, hatchability was more than 90%.

From the above results, the larval mark and cocoon color of Juhwangjam are plain and light pink, respectively. In spring season, the rearing results of a new silkworm strain, Juhwang, is match with the criteria for authorizing silkworm variety in

Korea. Juhwangjam is adaptable to rear in spring season rather than autumn season.

Artificial diet adaptability test results

Adaptability of young silkworm is one of important characters of silkworm variety. Artificial diet adaptability of Juhwangjam was tabled and compared with Kumokjam, a typical artificial diet adaptable silkworm variety in Korea (Table 3). Bristling percentage of Juhwangjam and Kumokjam was 100%, respectively. Larval period from 1st to 3rd instar of Juhwangjam and Kumokjam was the same as 9.09 d. Molting percentage of Juhwangjam was nearly 100%.

The above results indicated that Juhwangjam is adaptable to artificial diet culture like Kumokjam, a silkworm variety for artificial diet culture (Hong *et al.*, 1996).

Characteristics of parents strain

Major characteristics of parent strains, Jam 325 and Jam 326, of Juhwangjam were compared with Jam 311 and Jam 312 of control strain, Goldensilk (Table 4). A female parent of Juhwangjam, Jam 325 has larval mark and spins white peanut

Table 4. The major commercial characteristics of the parents of Juhwangjam

Variety	Useful hatchability	Larval period	Pupation percentage	Cocoon yield per 10,000 3rd molted larvae	Single cocoon weight	Cocoon shell weight	Cocoon shell rate
	%	days.hrs	%	kg	g	cg	%
Japanese races							
Jam311	89	23.22	96.6	14.5	1.58	26.5	16.8
Jam325	84	26.02	97.9	15.8	1.67	35.5	21.3
Chinese races							
Jam312	72	25.3	93.0	13.3	1.65	31.5	19.1
Jam326	95	25.2	91.0	13.5	1.68	26.9	16.0

Variety	Percentage of moth emergence	Duration from incubation to moth emergence	No.of eggs per batch	Percentage of moth laid normal eggs	Laval marking	Cocoon color
	%	days	ea	%		
Japanese races						
Jam311	100	55	581	100	Mark	Yellow
Jam325	100	54	542	100	Mark	White
Chinese races						
Jam312	99	54	511	78	Plain	Yellow
Jam326	96	54	569	89	Plain	Light pink

shaped cocoons. Its hatchability and pupation percentage were 84%, and 97.9%, respectively. The number of eggs per batch and percentage of moth laid normal eggs were 542 and 100%, respectively. Also, the larval period was 26 d 02 h.

A male parent of Juhwangjam, Jam 326 is a plain silkworm with light pink colored cocoon. It has good hatchability (95%), pupation percentage (91.0%), moth emergence percentage (96%), and moth laid normal egg percentage (89%), respectively. The number of eggs per batch was 569.

On the other hand, a male parent of Goldensilk Jam 312 has relatively poor at the point of hatchability (72%) and moth laid normal egg percentage (78%) compared to Jam 326.

In conclusion, a new silkworm variety with light pink cocoon, Juhwangjam exhibited similar rearing performance with good parental characteristics compared to authorized silkworm variety, Goldensilk.

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