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SUSCEPTIBILITY OF DIFFERENT SILKWORM BREEDS TO NUCLEAR POLYHEDROSIS AND BACTERIAL FLACHERIE UNDER NATURAL CONDITIONS

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ABSTRACT

Silkworm, *Bombyx mori* (L.), is susceptible to several diseases and no breed so far is reported to be immune. In the present investigations, 41 silkworm breeds of varied geographical origin were evaluated for their susceptibility to *Bombyx mori* nuclear polyhedrosis (*Bm*NPV) and bacterial flacherie under natural conditions. Significant difference was observed in larval and pupal mortality due to both nuclear polyhedrosis and bacterial flacherie. The highest larval mortality (9.29%) was observed in 'M_{57}' due to nuclear polyhedrosis and least (0.77%) in 'NB_4D_2' and '$SI_{(P)}$'. The larval mortality due to flacherie ranged from 0.67 to 7.22%. A significant variation was observed in pupation rate and highest pupation was noticed in 'Jam_{10}' (95.31), followed by '$S1_M$' (95.27), 'BL_1' (95.10), '$CP1_A$' (94.66), '$Pure_{81}$', (94.56), 'CPI_B' (94.33), '$S1_P$' (94.21), 'Chinese Farmer' (94.19), 'Chakwi' (94.09) and 'Chinese D_4' (94.03) which were statistically at par with one onother.

Key words: Breeding, *Bombyx mori* nuclear polyhedrosis, flacherie, silkworm, susceptibility

INTRODUCTION

Silkworm, *Bombyx mori* L., is prone to a number of pathogens which not only are present in the diseased worms but are also scattered in or around the rearing environments resulting in severe crop loss to the tune of 30-40% (Santha *et al*., 2007). European breeds reportedly are more susceptible than Japanese and Chinese breeds (Govindian *et al*., 1998). The varied susceptibility among silkworms is genetically determined and has extensively been studied involving silkworm viruses (Tanad and Kaya, 1993). Susceptibility/tolerance is an important complementary objective of silkworm breeding because high degree of susceptibility generally causes decrease in yield and quality while tolerance to diseases results in crop stability and increases productivity which can be achieved only through exploitation of disease-tolerant breeds. Grasserie and bacterial flacherie are very common diseases that affect the silkworm crop heavily, particularly during summers. Baig *et al*. (1991) screened several pure and hybrids silkworm breeds for their relative susceptibility to *Bombyx mori* nuclear polyhedrosis virus (*Bm*NPV) under natural and induced conditions and reported a significant variation in larval mortality among the breeds/hybrids. Illahi and Nataraju (2007) reported 13.8-26.0% loss due to Grasserie in Jammu and Kashmir resulting in a yield

reduction of 11.0 - 17.8 kg per 100 disease free layings. Sowmyashree and Nataraju (2007) also screened various multivoltine and bivoltine silkworm breeds against *Bm*NPV through inoculation followed by induction and found only 'Nistari', 'Pure Mysore' and 'BL_{36}' amongst the multivoltine and '61_N' amongst the bivoltine as relatively tolerant breeds. In the present study susceptibility status of some geographically diverse silkworm breeds against nuclear polyhedrosis and bacterial flacherie was studied under natural conditions of Kashmir.

MATERIALS AND METHODS

Disease free layings (Dfl's) of 41 silkworm breeds were procured from the Germplasm Bank of TSRI, SKUAST-Kashmir, Mirgund (India) and reared using the standard rearing procedure (Anonymous, 2003). The experiment was laid in a completely randomized block design during spring seasons (April-May) of 2012, 2013 and 2014, respectively. The rearing was conducted enmass upto 3nd instar and newly ecdysed 3rd moult larvae were classified into 3 replications of 100 larvae per replication and reared upto onset of spinning.

Observations were made on larval/pupal mortality and the dead larvae/ pupae were subjected to microscopic examination to ascertain the cause of their mortality. Pupation rate was calculated on the basis of live pupa inside the cocoon (Kumar *et al.,* 2002). Pooled data of three years, collected in respect of larval/ pupal mortality and pupation rate, was analyzed statistically using MS excel.

RESULTS AND DISCUSSION

A significant variation in larval/pupal mortality and pupation rate was recorded among the 41 breeds evaluated (Table 1). Significant difference in susceptibility was noticed in tested silkworm breeds due to both nuclear polyhedrosis and bacterial flacherie. Highest mortality of 9.29% was observed in 'M_{57}' due to nuclear polyhedrosis and least mortality of 0.77% in 'NB_4D_2' and '$SI_{(P)}$' silkworm breeds. The larval mortality due to bacterial flacherie among different silkworm breeds under study ranged from 0.67 to 7.22%. Pupal mortality due to nuclear polyhedrosis among the breeds ranged from 0.55 to 3.11%; however the pupal mortality due to flacherie ranged from 0.55 to 3.55% which varied significantly. A significant variation was observed in pupation rate which ranged from 82.16 to 95.31% with highest pupation rate in 'Jam_{10}' followed by '$S1_M$', 'BL_1', '$CP1_A$', $Pure_{81}$', 'CPI_B', '$S1_P$', 'Chinese farmer', 'Chakwi' and 'Chinese' which were statistically at par with one another.

Adequate variability amongst the silkworm breeds was found with respect to nuclear polyhedrosis and bacterial flacherie which proved that these breeds are divergent and quite diverse in expressing their tolerance to the diseases. These findings are in conformity with Govindan *et al.* (1998), Bhat (2006), Sowmyashree and Nataraju (2007), Bashir and Sharma (2008), Bhat and Nataraju (2010) and Bashir *et al*. (2011) who reported that no silkworm breed/ hybrid is completely immune to these diseases but only show variation in their susceptibility/tolerance. Baig *et al.* (1991) reported varied tolerance to Grasserie diseases among the tested breeds/hybrids. The varied susceptibility could be attributed to the genetic variance of silkworm breeds. The evaluated silkworm breeds could be utilized for hybridization enroute to evolving tolerant breeds/hybrids so as to enhance the cocoon production in the region.

Table 1: Disease incidence in different silkworm breeds against nuclear polyhedrosis and bacterial flacherie

Silkworm breeds	Origin	Average No. of larval mortality due to		Average No. of pupal mortality due to		Pupation rate (%)
		Grasserie	Flacherie	Grasserie	Flacherie	
M_{53}	Kashmir	3.4067	2.8133	0.8867	1.4433	91.450
M_{54}	Kashmir	4.4767	3.1033	0.6633	0.9933	90.497
M_{56}	Kashmir	1.3667	5.8133	1.2197	0.6633	90.940
M_{57}	Kashmir	9.2933	4.1067	3.1067	1.3300	82.163
M_{59}	Kashmir	4.8467	6.2533	2.4433	2.1100	84.520
M_{106}	Kashmir	2.5867	5.9933	1.6633	1.7767	88.047
Jam_2	Jammu	2.2900	6.4000	0.7733	1.4400	89.097
Jam_{10}	Jammu	1.5867	1.5500	0.6667	1.8833	95.313
Jam_{18M}	Jammu	4.8467	3.0333	0.9967	1.1067	90.017
Jam_{24}	Jammu	3.3300	7.2200	1.4400	1.5533	85.790
Jam_{21}	Jammu	4.2933	2.2800	2.5533	1.5533	89.320
NB_7	Karnataka	1.5533	3.0700	1.6633	1.5533	92.160
NB_{18}	Karnataka	2.4733	3.3300	1.1100	1.6633	91.390
NB_4D_2	Karnataka	0.7733	3.7600	1.2200	1.5533	92.673
JBC	Karnataka	2.1067	5.7367	2.1100	1.5533	88.477
JBEL	Karnataka	1.6933	3.5467	1.6633	2.1067	91.000
KPGB	Karnataka	1.8433	3.9967	1.7767	3.5533	88.830
C_{124}	Karnataka	2.7000	2.7767	2.2167	1.7733	91.533
KSC	Karnataka	2.4733	6.1800	0.7767	2.2167	88.363
$S1_M$	Karnataka	1.6233	0.6667	1.6633	0.7733	95.273
$S1_P$	Karnataka	0.7733	2.5900	1.1067	1.3300	94.210
9_M	Karnataka	2.9600	1.3633	1.2200	1.1100	93.347
9_P	Karnataka	2.1833	4.0733	1.2200	1.6667	90.857
KPG_4	Karnataka	3.2533	2.0400	2.5533	2.8867	89.267
KPG_5	Karnataka	3.3300	4.1433	1.7733	1.3300	89.423
SRC	Karnataka	2.1433	2.7767	1.4400	1.5533	92.087
New race	West Bengal	1.3700	3.3300	0.6633	1.1100	93.527
$Pure_{81}$	West Bengal	1.6633	1.4433	0.8867	1.4433	94.563
KA	West Bengal	1.7767	2.7733	2.7767	2.5167	90.157
$Pampore_5$	West Bengal	1.0700	4.1067	1.2200	2.1100	91.493
KYZ	West Bengal	2.9967	6.2167	2.1067	2.7733	85.907
S_{36}	West Bengal	1.9233	3.2167	1.2200	0.9967	92.643
RP_1	West Bengal	1.6633	2.3633	1.6667	2.6600	91.657
CPI_A	West Bengal	1.1800	1.5133	0.8867	1.7767	94.663
CPI_B	West Bengal	0.9133	3.4033	0.6600	0.6633	94.327
BL_1	West Bengal	0.8467	2.9567	0.5533	0.5533	95.100
SS	West Bengal	2.5100	2.6267	0.7733	1.5500	92.540
$Chinese_{D4}$	China	0.9067	2.5100	0.9967	1.5533	94.033
Chakwi	China	1.2533	2.2167	0.8867	1.5533	94.090
Chinese Farmer	China	1.7367	2.6267	0.6667	0.7767	94.193
King Haung	China	1.3700	2.2167	1.1067	1.7767	93.530
$CD_{0.05}$		2.70244	3.04990	ns	ns	6.0018

REFERENCES

Anonymous. 2003. *Package of Practices for Silkworm Rearing and Mulberry Cultivation in Kashmir.* Directorate of Extension Education, SK University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Kashmir (India).

Baig, M., Sharma, S.D., Balavenkatasubbaiah, M., Samsom, M.V., Sashidharan, T.O. and Noamani, M, K, R. 1991. Relative susceptibility of different races of silkworm (*Bombyx mori* L.) to nuclear polhedrosis under natural and induced condition, *Sericologia,* **39:** 417-420.

Bashir, I. and Sharma, S.D. 2008. Susceptibility of two popular hybrids of the silkworm, *Bombyx mori* L. to infection by five different microsporidia isolated from insects pests of mulberry and some other agricultural crop, *Journal of Experimental Zoology India*, **11:** 273-277.

Bashir, I., Sharma, S.D., Bhat, S.A. and Tantray, A.K. 2011. Susceptibility status of bivoltine breeds of silkworm, *Bombyx mori* L. to infection by different microsporidians. pp. 67-73. **In**: *Workshop on Recent Trends in Development of Bivoltine Sericulture in Jammu and Kashmir.* 29 October 2011, Department of Sericulture, J&K Government/Central Sericulture Research & Training Institute, Central Silk Board, Pampore (J&K), Srinagar, Kashmir (India).

Bhat, S.A. 2006. *Characterization of Microsporidian Infecting Lamerin Breed of the Silkworm, Bombyx mori L.* Ph.D. thesis, University of Mysore, Mysore, Karnataka, India.

Bhat, S.A. and Nataraju, B. 2010. Pathogenicity of two microsporidia to different breeds of the silkworm *Bombyx mori* L. *Bulletin of the Indian Academy of Sericulture*, **14:** 29-33.

Govindan, R., Narayanaswamy, T.K. and Devaiah, M.C. 1998. *Principles of Silkworm Pathology*. Scientific Publishers, Bangalore, India.

Illahi, I. and Nataraju, B. 2007. Prevalence of nuclear polyhedrosis in mulberry silkworm, *Bombyx mori* L. in Jammu and Kashmir. *Indian Journal of Sericulture,* **46:** 43-48.

Kumar, S.N., Basavaraja, H.K., Kumar, K.C.M., Reddy, M.N. and Datta, R.K. 2002. On the breeding of CSR18 x CSR19 a robust bivoltine hybrid of silkworm L. for the tropics. *International Journal of Industrial Entomology,* **10:** 153-162.

Santha, P.C., Bhargava, S.K, Sindagi, S.S. and Kamble, C.K. 2007. Bacterial flacherie of silkworm, *Bombyx mori* L. and its control by the application of antibiotics. *Journal of Experimental Zoology*, **10:** 1-7.

Sowmyashree, T.S. and Nataraju, B. 2007. Identification of silkworm breeds resistant to nuclear polyhedrosis through *Bm*NPV inoculation and induction. *Indian Journal of Sericulture,* **46:** 32-37.

Tanada, Y. and Kaya, H.K. 1993. Protozoan infection: Apicomplexa. Micospora. pp. 414-458. **In:** *Insect Pathology.* Academic Press, San Diego, USA.