INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

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SENSITIVITY OF SILKWORM BREEDS AND THEIR HYBRIDS OF *Bombyx mori* L. TO *Bm*NPV ON ET_{50} FOR SYMPTOM EXPRESSION (DAYS) AND TOTAL LARVAL MORTALITY (%)

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ABSTRACT
Sericulture is one of the oldest agro based industries in the world. Sericulture practices have undergone changes to improve productivity. Disease development and mortality are ever present phenomena in the silkworms as in other living organisms. The silkworm *Bombyx mori* due to its domestication, proned to many microbial infections they cause different diseases. Among silkworm diseases, grasserie, a viral disease of silkworm, *Bombyx mori* L. is causing great economic loss to sericulturists. Infection during fourth and fifth instar cause more ET_{50} value for symptom expression and less mortality in both the instars of Pure Mysore. Further, the same breed has taken more time (7.67 and 8.33 days) for first symptom expression. Among hybrids, PMxCSR_{16} has recorded highest ET_{50} value (5.67 and 6.67 days) for both (10^{-1} and 10^{-3}) viral dilutions respectively. However, the minimum (36.00 and 39.33%) larval mortality was noticed in 10^{-1} fed batches of pure Mysore and PMxCSR_4 hybrid respectively. Whereas, the fourth instar inoculated lots of CSR_2xCSR_4 and CSR_2xCSR_{16} have reported 100 percent total larval mortality indicating their high sensitive to the disease while the hybrids involving Pure Mysore multivoltine breed as maternal parents exhibited more ET_{50} value. In fifth instar, 10^{-1} fed batches caused 100% total larval mortality in CSR_2xCSR_{16} and minimum (38.00) was noticed in pure Mysore.

KEYWORDS: Silkworm, Pure breeds, Bivoltine, *Bm*NPV and Susceptibility.

INTRODUCTION

Domestication of the mulberry silkworm *Bombyx mori* L. has rendered it susceptible to a number of diseases caused by different pathogenic agents such as viruses, bacteria, fungus and microsporidia. *Bombyx mori* nuclear polyhedrosis virus (*Bm*NPV), which belongs to Baculoviridae, causes nuclear polyhedrosis in silkworms. Nuclear polyhedrosis is the most common viral disease and is prevalent in almost all the Sericultural areas in India. The incidence of nuclear polyhedrosis in India is reported to be 20-40% (Chitra *et al.*, 1975) and was estimated as 33-55% in different seasons in Karnataka, India (Nataraju *et al.*, 1998). The persistence of *Bm*NPV polyhedral, high temperature and humidity are the major factors that contribute to the crop losses due to nuclear polyhedrosis at farmer's level in India. The best approach to prevent an infectious disease such as nuclear polyhedrosis may be to use relatively tolerant silkworm breeds. This is due to the fact that the resistance to *Bm*NPV is controlled by polygenes (Aratake, 1973). Before initiation of any breeding programme for disease resistance/tolerance, the tolerance level of the available breeding resource materials should be explored. The present study was undertaken to screen the available pure breeds for their relative tolerance to *Bm*NPV and to identify and utilize the comparatively tolerant pure breeds for evolving certain crosses for use in future breeding programmes.

MATERIALS AND METHODS

To know the susceptibility of silkworm breeds against *Bm*NPV, the first day of fourth and fifth instar larvae of PM, CSR_2, CSR_4, CSR_{16} and their crosses *viz.*, PMxCSR_2, PMxCSR_4, PMxCSR_{16}, CSR_2xCSR_4, CSR_2xCSR_{16} and CSR_4xCSR_{16} were used for *Bm*NPV viral stress. All the parents and their hybrids were reared in three replications. After third moult 50 larave per each replication were taken and inoculated per orally. The leaf bits (10x12 cm size) were prepared, washed in running water and shade dried and sterilized. These mulberry leaf bits were smeared evenly with the virus suspension @ 0.25ml of *Bm*NPV PIB's by using non-absorbent cotton. After shade dried for five minutes they are fed to the silkworms. Control batches were fed with surface sterilized mulberry leaves for the first feed. Subsequent feeding was inoculum free leaves for both treated and untreated batches. These pure breeds and their hybrids were reared according to standard rearing practices (Dandin *et al.*, 2003). Data was collected on two rearing traits such as ET_{50} for symptom Expression (days) and Total larval mortality (%) for both the treated and untreated batches. To know their sensitivity against *Bm*NPV.

RESULTS AND DISCUSSION

ET_{50} for symptom expression (days)

Time taken for first symptom expression due to *Bm*NPV found significantly different in both the doses (10^{-1} and 10^{-3}) administered to fourth instar larvae in all the breeds and hybrids. Among hybrids, PMxCSR_{16} has recorded highest ET_{50} value (5.67 and 6.67 days) followed by CSR_4xCSR_{16} (5.67 and 6.33 days). The trend was found similar even in pure breeds. However, the Pure Mysore breed has taken more time (7.67 and 8.33 days) for first symptom expression due to *Bm*NPV and found to be more tolerant than other three bivoltine breeds experimented *viz.*, CSR_2 (5.67 and 7.00 days), CSR_4 (6.67 and 6.67 days) and CSR_{16} (5.33 and 5.67 days) (Table 1 & fig 1). At 10^{-1} viral dilution to fifth instar larvae resulted non-significant

results. Further, the 10^{-3} fed batches taken different days to express the symptoms of NPV. In general bivoltine crosses have shown more ET_{50} value *viz*., (7.67days) CSR_2xCSR_4, (7.67days) CSR_2xCSR_{16} and (8.33days) CSR_4xCSR_{16} compared to multivoltine crosses $PMXCSR_2$ (6.67days), $PMxCSR_4$ (7.33days) and $PMxCSR_{16}$ (7.33 days), respectively (Table 1 & fig 2).

TABLE- 1: Influence of *Bm*NPV infection at fourth and fifth instar inoculated batches of different silkworm breeds and their hybrids on ET_{50} for symptom expression (days) and total larval mortality (%).

Silkworm Breeds/ Hybrids	ET_{50} for symptom expression(days)		Total larval mortality (%)		ET_{50} for symptom expression(days)		Total larval mortality (%)	
	IV^{th} instar				V^{th} instar			
	10^{-1}	10^{-3}	10^{-1}	10^{-3}	10^{-1}	10^{-3}	10^{-1}	10^{-3}
PM	7.67	8.33	47.33 (6.91)	36.00 (6.04)	6.67	7.67	38.00 (6.20)	38.00 (6.20)
CSR_2	5.67	7.00	41.33 (6.47)	44.00 (6.67)	6.00	6.67	44.00 (6.67)	40.67 (6.41)
CSR_4	6.67	6.67	40.67 (6.41)	44.67 (6.72)	5.67	6.33	41.33 (6.47)	41.33 (6.47)
CSR_{16}	5.33	5.67	48.00 (6.96)	45.33 (6.77)	5.67	6.33	43.33 (6.62)	45.33 (6.77)
$PMxCSR_2$	5.33	6.33	42.00 (6.51)	44.00 (6.67)	5.67	6.67	44.67 (6.72)	45.33 (6.76)
$PMxCSR_4$	5.33	6.33	39.33 (6.30)	42.00 (6.52)	6.33	7.33	42.00 (6.52)	45.33 (6.77)
$PMxCSR_{16}$	5.67	6.67	44.00 (6.67)	44.67 (6.72)	6.00	7.33	43.33 (6.62)	43.33 (6.62)
CSR_2xCSR_4	5.33	6.33	0.00 (0.71)	44.00 (6.67)	5.33	7.67	41.33 (6.47)	42.67 (6.57)
CSR_2xCSR_{16}	5.67	5.67	100 (10)	100 (10)	5.67	7.67	100 (10)	100 (10)
CSR_4xCSR_{16}	5.67	6.33	43.33 (6.62)	42.67 (6.56)	6.33	8.33	46.00 (6.82)	42.67 (6.57)
Mean	5.83	6.53	34.60 (5.43)	38.73 (6.00)	5.93	7.20	38.40 (5.97)	38.47 (5.98)
F test	*	*	*	*	NS	*	*	*
SEm ±	0.333	0.365	1.445 (0.112)	1.801 (0.136)	0.350	0.333	1.660 (0.126)	1.578 (0.120)
CD at 5%	0.983	1.077	4.263 (0.330)	5.313 (0.402)	1.031	0.983	4.897 (0.371)	4.654 (0.353)

*: Significant; NS: Non-Significant

FIGURE-1: Sensitivity of silkworm breeds and hybrids (fourth instar inoculated) on ET_{50} for symptom expression (days) due to *Bm*NPV.

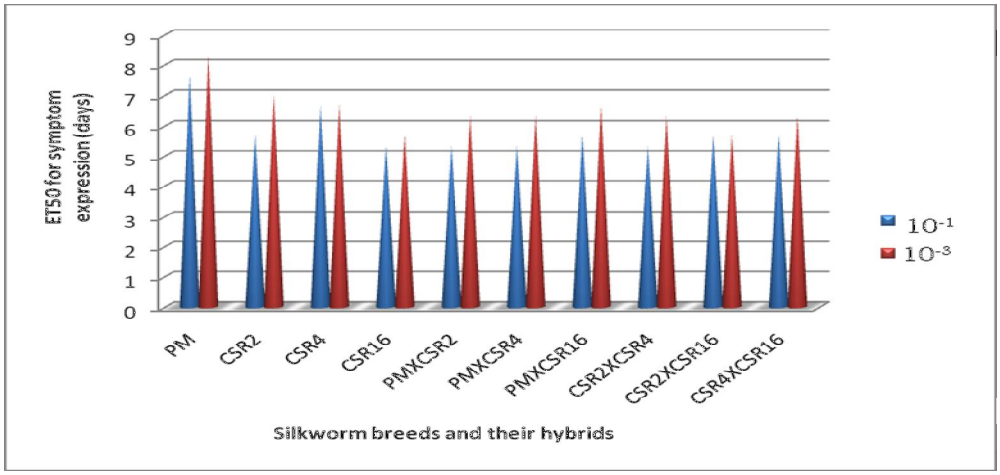
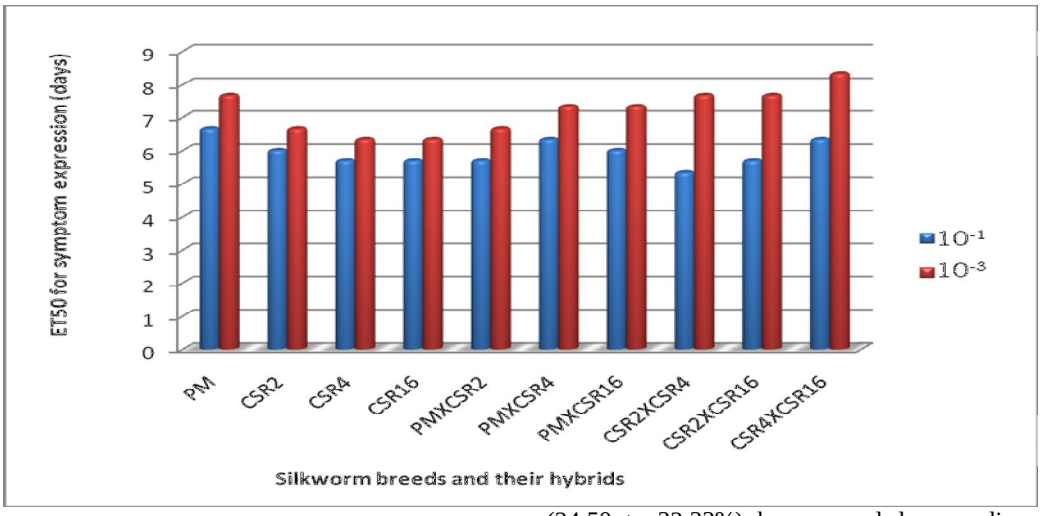


FIGURE-2: Sensitivity of silkworm breeds and their hybrids (fifth instar inoculated) on ET_{50} for symptom expression (days) due to *Bm*NPV.



Total larval mortality (%)

Laboratory experimental data on total mortality due to *Bm*NPV administered to multivoltine and bivoltine breeds and their hybrids resulted decreased total mortality with increased viral dilutions. The 10^{-1} fed batches caused 100 per cent total larval mortality in case of CSR_2xCSR_{16} followed by CSR_2xCSR_4. However, the minimum (36.00 and 39.33%) larval mortality was noticed in pure Mysore and $PMxCSR_4$ hybrid. The remaining bivoltine breeds *viz*., CSR_4 (40.67 and 44.67 per cent), CSR_2 (41.33 and 44 per cent) and CSR_{16} (48.00 and 45.33 per cent) recorded at 10^{-1} and 10^{-3} dilutions respectively. The Pure Mysore and their hybrids registered comparatively lesser total mortality (39.33 to 44.00 % and 42.00 to 44.67%) compare to biovoltine hybrids (16.27 to 19.36 and 34.60 to 44.00%). In fifth instar, the inoculated batches fed with 10^{-1} dilution caused 100% total larval mortality in case of CSR_2xCSR_{16}. However, the minimum (38.00) and maximum (46.00%) larval mortality was noticed in pure Mysore and CSR_4 $xCSR_{16}$ hybrid. The remaining bivoltine breeds *viz*., CSR_2 (44.00 and 40.67%), CSR_4 (41.33% and 41.33%) and CSR_{16} (43.33 and 45.33 %) recorded same trend at 10^{-1} and 10^{-3} dilutions respectively.

These experimental results are in conformity with the findings of other researchers. However, administration of different dilutions of *Bm*NPV to silkworm breeds and their hybrids exhibited significant results on both ET_{50} for symptom expression and mortality. It is very clearly indicated that, increased viral dilution exhibited higher ET_{50} value which was observed for PM 8.33 and 7.67 (10^{-3}). In fifth instar inoculated batches recorded non significant at $10^{-}1$. In general PM and its components expressed higher ET_{50} values compared to bivoltine components. Findings of Ravikumar *et al.* (2003) when different breeds and their hybrids administered with *Bm*NPV, CSR_4xCSR_5 expressed 12.74 and 12.49 days for ET_{50} mortality than KSO-1 (12.30) and NP_2 (12.95) days respectively. Further, Baig *et al.* (1991) studied the relative susceptibility of different races of silkworm, according whom the bivoltine races were found to be comparatively more susceptible than multivoltine races. The hybrids of bivoltine (42 to 53%) and multivoltine (24.50 to 32.33%) have recorded more disease due to grasserie. Bhaskar *et al.* (2002) have reported minimum ET50 for mortality but maximumin KSO1 among bivoltine breeds. Further, the lowest ET_{50} value (8 days) recorded for $PMxNB_4D_2$ when fed with stock suspension of kenchu virus compared to 10^{-5} dilution (33 days) they also confirmed that, PM and NB_7 and their components have recorded minimum and maximum ET_{50} values Bhaskar *et al.* (1987) as reported in the present study.

Results pertaining to total mortality were significant among fourth and fifth instar inoculated lots of silkworm breeds. In fourth instar, CSR_{16} (48.00 to 45.33%) and (43.33 and 45.33%) was recorded maximum larval mortality in both the inoculated batches with *Bm*NPV and 100 per cent mortality was witnessed by CSR_2xCSR_{16} in 10^{-1} and 10^{-3} viral dilutions. These results are in parity with findings of Sudhakara Rao *et al*. (2006) indicated that, the inheritance pattern of two selected donor parents *C. Nichi* and A were indicated that the mortality of *C. Nichi* (R) was only 21% and the mortality of A is found to be 27% whereas susceptible breed NB_4D_2 (S) was recorded 100 per cent due to *Bm*DNV1. Further they also confirmed, selected hybrids and their parents of *C.Nichi* and NB_4D_2 changed their survival percentage *ie*., *Bm*IFV (71 to 87%) and *Bm*NPV (60 to 65%) and indicated that, the evolved breeds and their hybrids acquired resistance charecters against both the viral infections. Sowmyashree and Nataraju (2007) also inferred that, when (24)bivoltine and (23)multivoltine silkworm breeds administered with *Bm*NPV ($6x10^{-6}$/ml) the highest survival per cent of 58.80 noticed for CSR_{19} compared to (CSR_2 39.70%) and (CSR_{19} 39.61%).

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