

## **SURVEY ON THE PREVALENCE OF GREEN MUSCARDINE DISEASE IN THE SERICULTURAL AREAS OF KARNATAKA, INDIA**

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In India, white muscardine is most common among fungal diseases in silkworm which causes considerable cocoon crop loss every year especially during rainy and winter seasons. It is a general view that the incidence of green muscardine is sporadic in India and do not cause any significant damage to the sericultural crops. No systematic study on this disease and its prevalence is available. In the present paper, results confirmed the wide prevalence of green muscardine disease along with white muscardine disease in all the sericultural areas of Karnataka, India. One year survey results, covering all the three seasons in five sericultural areas of Karnataka viz. Mandya, Kolar, Hassan, Kushalnagar and Chamarajanagar indicated the prevalence of white and green muscardine diseases through out the year. The prevalence was high during rainy season when 30% of the farmers crop had green muscardine in their rearings followed by winter (14.00%) and summer (2.00%).

**Key words :** Survey, prevalence, green muscardine, sericultural areas, Karnataka.

### **INTRODUCTION**

Among fungal diseases, muscardine is the most fatal and disastrous one. The disease is highly contagious and inflict heavy loss to the cocoon crops every year especially during rainy and winter seasons. Mukherji (1912) reported high incidence of muscardine during rainy season in West Bengal whereas Samson *et al.* (1975) reported high prevalence of muscardine during winter season in Karnataka. There are different types of muscardine named according to the colour of the conidia *i.e.* white, green, yellow and black. In India, white muscardine caused by *Beauveria bassiana* is well known and an estimated crop loss worth of 3 crores during 1974 - 75 and Rs. 50 lakhs in 1975 - 76 (Baig & Sengupta, 1988). Loss due to white muscardine disease has been estimated to vary from 5 - 40% in different countries (Jayaramaiah *et al.*, 1986). *Metarrhizium anisopliae* and *Nomuraea rileyi* are the two major fungal pathogens causing green muscardine disease in insects. *Nomuraea rileyi* is a cosmopolitan species. In India also, natural occurrence of this fungus has been reported on a variety of insects (Phadke *et al.*, 1978; Ambethkar, 2002). *Metarrhizium anisopliae* is common in European countries and *Spicaria prassina* (*Nomuraea rileyi*) is common in Japan. There are no reports available on the extent of prevalence of green muscardine in silkworm in India. Hence, an elaborate study on the green muscardine disease is essential for effective management of the disease. Keeping this in view, a survey on the prevalence of Green muscardine disease in selected sericultural areas of Karnataka was conducted and the fungal pathogen causing green muscardine disease was isolated from the infected silkworm and was tested for Koch's postulates. For comparison purpose, survey also included the prevalence of white muscardine which is more common in occurrence.

## MATERIALS AND METHODS

The survey on the prevalence of muscardine disease (both white and green) was conducted in the following selected sericultural areas of Karnataka *viz.*, Mandya, Kolar, Hassan, Kushalnagar and Chamarajanagar (Fig. 1) in three different seasons *viz.*, Rainy, Winter and Summer during the year 2007-08. From each season and in each area 10 farmers' crops having 5<sup>th</sup> instar silkworm rearing were surveyed. Before observing the crop, following information was collected from each farmer.

- Farmer's name and Address
- No. of dfls.. brushed, breed/ hybrid and date of brushing
- Mulberry garden details
- Rearing house details
- Disinfectants and bed disinfectants applied

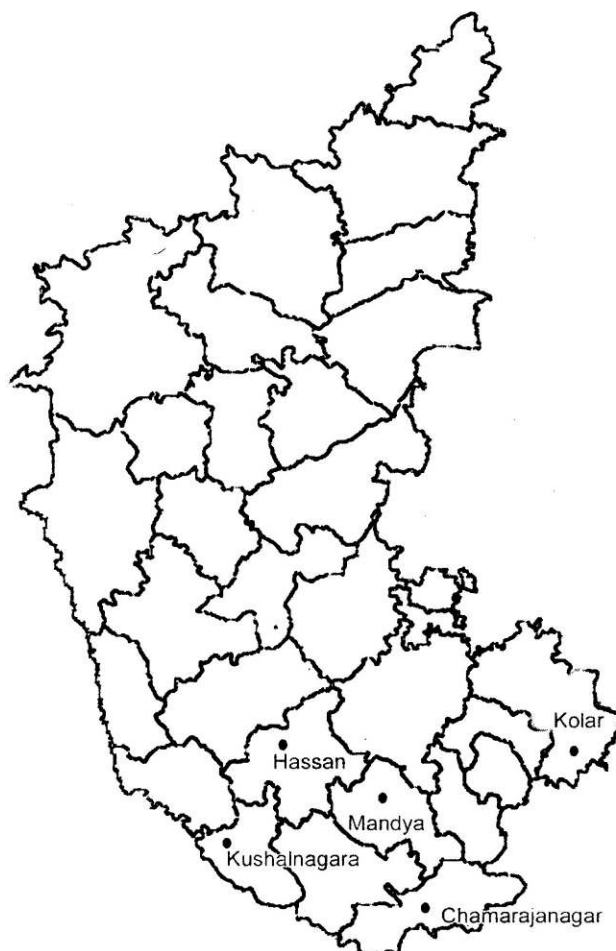
After collection of data, the following estimations were done in the farmer's crop during the time of visit

- Total rearing bed area (in sq. ft.)
- No. of larvae present in sq. ft. area of larval bed
- No. of larvae present in the 10% larval rearing bed area
- No. of larvae present in the total larval rearing bed area

Each farmer's crop was observed for the presence of muscardine larvae. 10 % larval bed area was observed for the presence of green and white muscardine larvae and then calculated no. of infected larvae in the entire bed area. From all the 10 farmers crops same method was followed to observe the prevalence of white and green muscardine diseases. The survey was conducted during rainy season, 2007, winter season, 2007-2008 and summer season, 2008. Samples of white and green muscardine larvae were collected and brought to the Silkworm Pathology Laboratory, Central Sericultural Research and Training Institute, Mysore and incubated in high humidity condition for 5 days and observed for any change in conidial colour. The pathogen from green muscardine infected mummified larvae was isolated and cultured in Potato Dextrose Agar (PDA) media as described by Garraway & Evans (1984) and Milan Kumari, (2004). The isolated pathogen was inoculated to the silkworms by topical application and confirmed its pathogenicity to silkworm as per the Koch's Postulate.

## RESULTS

The survey results on the prevalence of white and green muscardine diseases during rainy season are presented in Table I and II respectively. In Mandya area, no incidence of white and green muscardine diseases was recorded in all the 10 farmers' crops surveyed. In Kolar area, 6 out of 10 crops revealed the presence of white muscardine of which four crops also had green muscardine disease. In Hassan area, out of 10 crops, 7 crops revealed the prevalence of both white muscardine and green muscardine diseases. In Kushalnagar area, 4 crops out of 10 revealed the presence of white muscardine in which 3 crops were also having green muscardine disease. In Chamarajanagar area, 3 out of 10 crops revealed white muscardine along with white muscardine. As a whole, 40% of the total crops (50) surveyed during rainy season revealed white muscardine and 30% of



**Fig. 1:** Selected survey areas in Karnataka for estimation of prevalence of green muscardine disease in silkworm rearings.

of crops recorded the prevalence of green muscardine disease.

The survey results on prevalence of white and green muscardine diseases during winter season are presented in Table III and IV respectively. Out of the total 10 crops surveyed in Mandya area, 7 crops revealed the presence of white muscardine disease in which 3 crops were also having green muscardine disease. In Kolar area, only 2 crops were found to have white muscardine disease and there was no green muscardine incidence in the surveyed crops during this period. In Hassan area, five crops revealed the prevalence of white muscardine disease, in which 2 crops were also found to have green muscardine disease. In Kushalnagar area, 3 crops revealed white muscardine disease and

**Table I :** Survey on the prevalence of White Muscardine disease in different sericultural areas of Karnataka during Rainy season.

S. No.	Name of the Area	No. of farmers crops surveyed	Farmers crops having White muscardine disease	
			No.	%
1.	Mandya	10	0	0.00
2.	Kolar	10	6	60.00
3.	Hassan	10	7	70.00
4.	Kushalnagar	10	4	40.00
5.	Chamarajanagar	10	3	30.00
<b>Total/Average</b>		<b>50</b>	<b>20</b>	<b>40.00</b>

**Table II :** Survey on the prevalence of Green Muscardine disease in different sericultural areas of Karnataka during Rainy season.

S. No.	Name of the Area	No. of farmers crops surveyed	Farmers crops having Green muscardine disease	
			No.	%
1.	Mandya	10	0	0.00
2.	Kolar	10	4	40.00
3.	Hassan	10	7	70.00
4.	Kushalnagar	10	3	30.00
5.	Chamarajanagar	10	1	10.00
<b>Total/Average</b>		<b>50</b>	<b>15</b>	<b>30.00</b>

**Table III :** Survey on the prevalence of White Muscardine disease in different sericultural areas of Karnataka during Winter season.

S. No.	Name of the Area	No. of farmers crops surveyed	Farmers crops having White muscardine disease	
			No.	%
1.	Mandya	10	7	70.00
2.	Kolar	10	2	20.00
3.	Hassan	10	5	50.00
4.	Kushalnagar	10	3	30.00
5.	Chamarajanagar	10	2	20.00
<b>Total/Average</b>		<b>50</b>	<b>19</b>	<b>38.00</b>

**Table IV :** Survey on the prevalence of Green Muscardine disease in different sericultural areas of Karnataka during Winter season..

S. No.	Name of the Area	No. of farmers crops surveyed	Farmers crops having Green muscardine disease	
			No.	%
1.	Mandya	10	3	30.00
2.	Kolar	10	0	0.00
3.	Hassan	10	2	20.00
4.	Kushalnagar	10	1	10.00
5.	Chamarajanagar	10	1	10.00
<b>Total/Average</b>		<b>50</b>	<b>07</b>	<b>14.00</b>

one of these crops also revealed the presence of green muscardine. White muscardine disease was revealed in 2 crops in Chamarajanagar area and one of these was also affected with green muscardine. Out of the 50 crops surveyed in the 5 sericultural areas during winter season, 38% crops revealed the prevalence of white muscardine and 14% crops recorded the prevalence of green muscardine disease.

The survey on prevalence of white and green muscardine diseases during summer season is presented in Table V and VI, respectively. In Mandya area, no incidence of white or green muscardine disease was noticed during this period in all the ten crops surveyed. Where as in Kolar, only one crop revealed the presence of white muscardine disease and there was no green muscardine disease. In Hassan area, out of 10 crops, only one crop revealed the prevalence of both white and green muscardine diseases. In Kushalnagar and Chamarajanagar areas no prevalence of both white and green muscardine diseases were noticed. As a whole, 4% of crops were having white muscardine and 2% of crops recorded the incidence of green muscardine disease during summer season.

**Table V :** Survey on the prevalence of White Muscardine disease in different sericultural areas of Karnataka during Summer season.

S. No.	Name of the Area	No. of farmers crops surveyed	Farmers crops having White muscardine disease	
			No.	%
1.	Mandya	10	0	0.00
2.	Kolar	10	1	10.00
3.	Hassan	10	1	10.00
4.	Kushalnagar	10	0	0.00
5.	Chamarajanagar	10	0	0.00
<b>Total/Average</b>		<b>50</b>	<b>02</b>	<b>4.00</b>

**Table VI :** Survey on the prevalence of Green Muscardine disease in different sericultural areas of Karnataka during Summer season.

S. No.	Name of the Area	No. of farmers crops surveyed	Farmers crops having Green muscardine disease	
			No.	%
1.	Mandya	10	0	0.00
2.	Kolar	10	0	0.00
3.	Hassan	10	1	10.00
4.	Kushalnagar	10	0	0.00
5.	Chamarajanagar	10	0	0.00
<b>Total/Average</b>		<b>50</b>	<b>01</b>	<b>2.00</b>

## DISCUSSION

The survey results clearly indicate the prevalence of green muscardine disease in all the sericultural areas of Karnataka. The prevalence was high during rainy season (30%) followed by winter (14%) and significantly low during summer season (2%). The prevalence of white muscardine disease was also high during rainy season (40.00%) followed by winter (38%) and summer season (4%). These results on the prevalence of

muscardine disease are in concurrence with the earlier survey reports. The survey conducted by Samson *et al.* (1975) indicated 34.1, 12.9 and 11.1% incidence of white muscardine in Channapatna area and 20.5, 15 and 5% in Kolar areas of Karnataka during winter, rainy and summer seasons respectively. Balavenkatasubbaiah *et al.* (1992) recorded 29.77, 18.15 and 1.89 % muscardine incidence of the total disease incidence in Karnataka during rainy, winter and summer seasons respectively. Further, Selvakumar *et al.* (2002), based on a survey conducted over a period of 4 years involving a total of 2,821 crops also reported the prevalence of silkworm diseases and estimated crop loss due to diseases in Karnataka. According to the study, among the diseases, incidence of muscardine was high during rainy (17.96%) and winter (17.36%) seasons. However, all these surveys did not include green muscardine. Our laboratory studies on the germination of green muscardine conidia showed requirement of continuous high humidity and also that the larval colour of infected larvae remains white for initial 1-2 days of mummification and afterwards, it changes to green. Due to this reason, incidence of green muscardine during silkworm rearing normally goes unnoticed and is recorded as for white muscardine.

The environmental factors influence and determine the germination, growth and sporulation of the fungal pathogen in nature. Different species of fungi have different requirements of environmental conditions for germination and infection on different hosts. Both low temperature and high humidity plays a major predisposing role on the outbreak of muscardine disease during rainy and winter seasons. Survival of the conidia as well as its germination depends on the prevailing temperature and humidity. *B. bassiana* needs higher relative humidity although it require lower humidity at low temperature and higher humidity levels at higher temperature for maximum mycelial growth and sporulation. Kuberappa & Jayaramaiah (1987) found that optimum growth, sporulation and development of *B. bassiana* occurred at 20 - 30°C and 80 - 96% relative humidity. Likewise the white muscardine, the incidence of green muscardine in the field may also be governed by the prevailing environmental conditions which needs to be studied in detail. These studies will help in devising proper management strategies for the prevention/control of green muscardine.

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