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Impact of abiotic stresses on summer preservation of ecorace bhandara of *Antheraea mylitta* D

Tushar R Khare
Scientist-B, P3, Basic Seed Farm, National Silkworm Seed Organization, Central Silk Board, Mysore, Karnataka, India

Abstract
Of the 44 ecoraces of tropical tasar silkworm *Antheraea mylitta*, Drury across the India, Bhandara ecorace is one of population available in Vidarbha region of Maharashtra. Its natural population has decreased down due to it's over exploitation by tribals and traders, deforestation and change in atmospheric conditions. To save the natural population efforts are made to collect third generation wild cocoons from its natural habitats and kept under summer preservation for its further multiplication. The third generation harvested cocoons kept under summer preservation exposes to various abiotic stresses results in great difficulty in its further multiplication. This three year (2016 to 2018) study was under taken to understand and form a database on impact of abiotic stresses on summer preservation loss of ecorace Bhandara. Based on the results of three years of study it was revealed that abiotic stresses (mainly temperature, humidity and rainfall) leads to total cocoon preservation loss of 25.80, 47.04 and 41.91% during the year of 2016, 2017 and 2018 respectively. Of which loss due to pupal mortality and unseasonal emergence stands at 7.14, 37.26, 27.41% and 18.66, 9.78, 14.5% during 2016, 2017 and 2018 respectively. Pupal mortality and unseasonal moth emergence is the major factors for loss of seed cocoons resulted from fluctuation in temperature and relative humidity. The maximum loss of cocoons due to unseasonal moth emergence was found in the month of June followed by May while the maximum loss due to pupal mortality was found in the month of May followed by June. Cocoon loss under preservation was found minimum from February to April (2.22 -12.36%) while maximum from May to June (23.58-45.05%). Result indicated that May and June month is the most critical period for ecorace as during this period cocoons adversely exposed to prevailing abiotic stresses. Hence, there is urgent need of developing technology to protect exposure of summer preserved cocoons to fluctuation in temperature and relative humidity so that loss of valuable genetic material could be avoided.

Keywords: abiotic stresses, ecorace Bhandara, summer preservation losses

1. Introduction

Of the 44 wild eco-races of *A. Mylitta*, which are confined to different ecological niches in India, the eco-race Bhandara is a commercially important wild tropical tasar silkworm having enormous quality of economic traits *viz*., hard and compact cocoon shell, higher shell weight (male-22.08 (g) and female-19.43(g), higher shell ratio (male-1.61 and female- 2.36), low denier (8) and pebrin disease resistance with the better luster (Singh *et al*., 2014) [3]. Owing to almost double the silk content of this ecorace compared to ruling Daba ecorace, it has got potential to double the income of tribal sericulturist. But, its natural population has decreased down due to it's over exploitation by tribals and traders, deforestation and change in atmospheric conditions and therefore presently it has reached to the brink of extinction. To utilize this eco-race commercially, it is necessary to multiply its population artificially (Barsagade *et al.*, 2012) [1]. Keeping above fact in mind the first step has been taken to collect the wild ecorace cocoons from its natural habitat and kept under summer preservation. This ecorace is tri-voltine in nature and undergo pupal diapauses from February to mid-June, known as summer preservation. Further summer preservation of seed cocoons exposes to various abiotic stresses results in great difficulty in its further multiplication. This study is an effort to understand and form a database on impact of abiotic stresses on summer preservation loss of ecorace Bhandara.

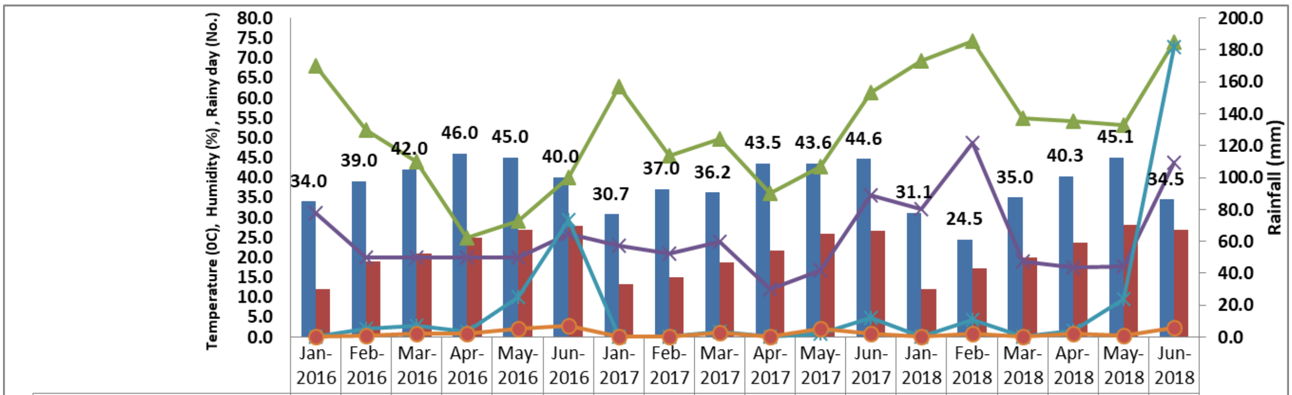
2. Materials and Methods

Summer preservation trail was conducted at the Regional Sericultural Research Station, Bhandara (21.17° N 79.65° E; 244 m above mean sea level) during 2016 to 2018. Ecorace Bhandara adopts tri-voltine nature under tropical climate of Vidarbha and complete its three life cycles in a year. The source of third generation ecorace seed cocoons kept under preservation (February to mid-June) is its natural habitat which lies in four districts (Bhandara, Gondia, Chandrapur and Gadchiroli) of Vidarbha region of Maharashtra. This eco-race seed cocoons were preserved under grainage house during summer period. The data on unseasonal emergence and pupal mortality was recorded by using standard procedure. Meteorological data were collected regularly.

3. Results and Discussion

The third generation harvested cocoons kept under summer preservation exposes to various abiotic stresses results in great difficulty in its further multiplication. During this period pupae is especially exposed to high temperature and low humidity. Based on the results of three years of study it was revealed that abiotic stresses (mainly temperature, humidity and Rainfall) leads to total cocoon preservation loss was 25.80, 47.04 and 41.91% during the year of 2016, 2017 and 2018 respectively. Of which loss due to pupal mortality and unseasonal emergence stands at 7.14, 37.26, 27.41% and 18.66, 9.78, 14.5% during 2016, 2017 and 2018 respectively. This data revealed that the pupal mortality and unseasonal emergence is the major factor responsible for loss of valuable ecorace Bhandara seed cocoons under summer preservation. It is also noted that minimum preservation loss was found from the February to April (i.e. up to 2.22%, 1.99% and 12.36% during 2016, 2017 and 2018 respectively) while maximum loss found from May to June (i.e. up to 23.58%, 45.05% and 29.55% during 2016, 2017 and 2018 respectively).

The trend of monthly preservation loss during all three individual years (2016 to 2018) of study shows that the maximum loss of cocoons due to unseasonal moth emergence was found in the month of June followed by May. Unseasonal moth emergence might be due to increased level of humidity in the month of June resulted from occurrence of some unseasonal rains. Similarly, maximum monthly preservation loss due to pupal mortality during the year 2016 and 2018 was found in the month of May followed by June. This might be due to exposure of pupae to extreme hotter period of the year which falls in the month of May. This finding is in line with Sisodia and Gaherwal (2017) [4]. Contradictory to the year 2016 and 2018, the preservation loss due to pupal mortality during the year 2017 was found maximum in the month of June followed by May. The reason for higher pupal mortality in the month of June (2017) was due to the carryover of temperature in increased trend from the month of May (43.60 ºC) to June (44.64 ºC) coupled with less rain (12 mm) in only two rainy days in the first fortnight of June compared to rest years of study (Meteorological data presented in fig. 1). Kumar *et al.* (2012) [2] also reported that long term exposure of pupae to extreme temperature (46.0 ºC) cause pupal mortality.



	Jan-2016	Feb-2016	Mar-2016	Apr-2016	May-2016	Jun-2016	Jan-2017	Feb-2017	Mar-2017	Apr-2017	May-2017	Jun-2017	Jan-2018	Feb-2018	Mar-2018	Apr-2018	May-2018	Jun-2018
TEMPARATURE (°C) MAX	34.0	39.0	42.0	46.0	45.0	40.0	30.7	37.0	36.2	43.5	43.6	44.6	31.1	24.5	35.0	40.3	45.1	34.5
TEMPARATURE (°C) MIN	12.0	19.0	21.0	25.0	27.0	28.0	13.4	15.0	18.8	21.8	25.8	26.5	12.1	17.2	20.0	23.8	28.2	26.9
HUMIDITY (%) MAX	68.0	52.0	44.0	25.0	29.0	40.0	62.8	45.5	49.6	36.0	42.6	61.3	69.2	74.3	55.0	54.3	53.3	74.0
HUMIDITY (%) MIN	31.0	20.0	20.0	20.0	20.0	26.0	23.0	21.0	23.8	12.0	16.8	35.5	32.2	48.7	19.0	17.5	17.6	43.7
Rainfall (mm)	0.0	5.0	7.4	3.2	25.2	73.5	0.0	0.0	3.5	0.0	2.4	12.0	0.0	11.0	0.0	4.0	24.0	182.0
Rainy days	0.0	1.0	2.0	2.0	5.0	7.0	0.0	0.0	3.0	0.0	5.0	2.0	0.0	2.0	0.0	2.0	1.0	6.0

Fig 1: Monthwise meteorological data during the summer preservation period (2016-2018)

Table 1: Monthwise data on ecorace Bhandara seed cocoon loss during the summer preservation

Year	Total cocoons kept	Feb			March			April			May			June			Progressive Total
		UE	PM	Total	UE	PM	Total	UE	PM	Total	UE	PM	Total	UE	PM	Total	
2016	4549	09	00	09	20	0	20	28	44	72	304	178	407	488	103	666	1174
2017	17053	0	0	0	0	0	0	0	341	341	130	723	853	1538	5291	6829	8023
2018	12430	0	0	0	0	0	0	203	1334	1537	287	1967	2254	1312	107	1419	5210
Total	34032	00	0	00	20	0	20	231	1719	1950	721	2868	3589	3338	5501	8839	14407

UE- Unseasonal emergence & PM- Pupal mortality

4. Conclusion

It can be concluded that pupal mortality and unseasonal moth emergence resulting from fluctuation in temperature and relative humidity especially in the critical month of May and June is the major hurdles in population buildup and commercial exploitation of this ecorace. Hence, there is urgent need for developing technology to protect the exposure of summer preserved cocoons to fluctuation in temperature and relative humidity so that loss of valuable genetic material could be avoided.

5. References

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