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Research article

STUDIES ON THE GENETIC VARIABILITY IN THE ECORACES OF ANTHEREAE MYLITTA DRURY IN RELATION TO THE ENVIRONMENTAL FACTORS

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ABSTRACT: *Antheraea mylitta* produces tasar silk and is an endemic species of the Indian subcontinent. Populations of this species show a certain degree of phenotypic variability for which they are designated as 'ecoraces'. Inorder to study the genetic variability in relation to the environment among *Daba T.V* and *Andhra local* the life history of two ecorace from hatching to egg laying stage and the cocoon characters were enumerated. Andhra local ecorace has exhibited superior qualities in fecundity, shell ratio,silkyield,filament length,reelability and denier whereas mothemergence, larvalweight, cocoonweight,shell weightand effective rate of rearing have been encouraging in Daba T.V.Thus the variations in the above characters could be attributed to the genetic variability between the two ecoraces rather than the environment influence as they are reared under similar environment.

Key words: *Anthereae mylitta Drury, Daba T.V, Andhra local,* environment

INTRODUCTION

Anthereae mylitta.Drury a lepidopteran insect of the Saturniidae family produces tasar silk of commercial importance. This species is endemic and distributed in different geographical regions of India in the form of ecological races. They show variation in their phenotypic traits such as fecundity, voltinism, cocoon weight, silk ratio and also in their host plant preference (Sinha et al., 1994). The influence of environment on silk worm rearing performance was studied by Mohapatra (2009); Reddy et al., (2009). There is a tremendous variability among and between the ecotypes and ecoraces of Antheraea mylitta (Sinha et al.,1992). This variability in the ecoraces results in genetic diversity between the ecoraces of A.mylitta which attributes for their adaptation at different ecological conditions. Crop improvement depends upon the magnitude of genetic variability and the extent to which the desirable quantitative characters are heritable (Siddiqui et al., 1985). Andhra local, the exclusive ecorace of Andhra Pradesh is well known for its awesome commercial characters like compact and hard cocoons, high reelability, high shell ratio, low denier and high filament length (Thangavelu, 1991 and 1992). In this ecorace there are certain weaknesses like weak voltinism, indefinite period of diapauses leading to erratic moth emergence, poor coupling and the race may become extinct if proper measures towards protection and conservation are not taken (Thangavelu, 1993).

The present analysis on the environmentally superior and inferior traits in the ecoraces helps to note the genotypic variability and easy selection of ecorace for the improvement of economically important traits and finally Andhra local ecorace can be protected from extinction.

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MATERIALS AND METHODS

In the month of April 150 Andhra local and Daba T.V Tasar cocoons of each were collected from the forest patches as per standard norms such as weight, colour, size of cocoons and length of peduncle.The cocoons were accomadated seperately in wire mesh cages of size 2ftX2ftX2ft. Cages were disinfected with 2% Formaldehyde **(**Jolly et al., 1974**).** From April to May 42 ±2% relative humidity and 30±2^{o}C room temperature were maintained.In the month of June temperature has been reduced to 29± 1^{o}C and relative humidity increased to 70 ± 5 % to get uniform moth emergence. The cocoons harvested from first and second crops were selected as per standard norms and preserved for preparation of (DFL's) disease free layings for second and third crops.The grainage operations were conducted in September for second crop and November for third crop. The emerged moths after coupling were allowed to lay eggs in the mud cups. The average fecundity was recorded for the three crops. After egg laying the abdominal portion of the mother moth was crushed with moth crushing set with 1 or 2 drops of 2% KOH solution. A drop of the suspension was taken on clean glass slide and examined under light microscope at 600X magnification for pathogens. Eggs laid by diseased moths were rejected.DFL's were prepared and surface sterilized by 5% Formaldehyde. The disinfected eggs were kept in specially designed egg boxes and preserved in incubator at 25-30^{o}C temperature and 75+-5% relative humidity till eigthday. Small twigs of Terminalia arjuna plant with tender leaves were placed in plastic basins into which the incubated eggs were released. The hatched larvae were brushed on the Terminalia arjuna plantation raised in fields of central silk board Chennor,Adilabad District, Andhra Pradesh.The characters like erratic emergence, fecundity, larval weight, cocoon weight, shell weight, shell ratio,single cocoon silk yield, filament length,reelability, denier and ERR were studied in the two ecoraces for the three crops.The larval weight, cocoon weight and shell weight were measured on electronic balance

RESULTS AND DISCUSSION

The present studies on first crop show 30% of erratic emergence in *Andhra local* and 10% in *Daba T.V*. and remaining were regular emergence. In second and third crops erratic emergence was found to be absent in both the ecoraces. Andhra local ecorace exhibits 32% of erratic emergence in the first crop (Jayaprakash 1995).) Andhra local has high pupal mortality and high erratic emergence (Thangavelu1993). Even though same relative humidity and temperature were maintained the high erratic emergence in Andhra local when compared to Daba T.V was recorded which could be attributed to genetic weakness of *Andhra local* rather than influence of environmental factors and also shows genetic variation between ecoraces for this trait.(Table-1).

In similar environmental conditions during first,second and third crops,*Andhra local* ecorace exhibited 6,14,17% more fecundity than Daba T.V. and fecundity found to be increased from first crop to third crop in both the ecoraces. This shows minimum environment influence on fecundity and the two ecoraces are genetically variable towards this trait.Siddiqui et al., (1988) working on genotypic variability of some quantitative characters in A.mylitta.D.(Daba, RF1, RF4, RF35, RS and Laria-8 and 15 crosses of these lines) has reported the high percentage of heritability in fecundity. Sen et al., (1995) studying on genetic parameters in B.mori has observed minimum environment influence and maximum percentage of heritability in fecundity. (Table-1).

The larval weigths found to be increased from first crop to third crop in both the ecoraces. Under similar environmental conditions the larval weights of Daba T.V recorded for three crops were 16.7, 16.9 and 11.8% more than

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Andhra local. The previous reports by Siddiqui et al.,(1988) on the larval weight in A.mylitta (Daba, RF1, RF4, RF35, RS and Laria-8 and 15 crosses of these lines) have shown that the percentage of heritability is high in this trait. Sen et al.,(1995) working on B.mori concluded that larval weight is a heritable trait and genetic advance is also high for this trait due to additive gene action. Thus the difference in the larval weight in the two ecoraces can be related to the genetic variability.

Table: 1 Physical parameters and cocoon characters of *A.mylitta (Andhra local*) in three crops

Crop	Erratic emergence	Fecundity	Larval weight(g)	Cocoon weight(g)	Shell weight(g)	Shell ratio (%)
Crop1	45	176	27	7.9	0.89	11.26
Crop2	--	205	30	8.1	1.12	13.82
Crop3	--	210	36	8.7	1.29	14.82

Table: 2 Physical parameters and cocoon characters of *A.mylitta (Daba T.V)* in three crops

Crop	Erratic emergence	Fecundity	Larval weight (g)	Cocoon weight (g)	Shell weight (g)	Shell ratio (%)
Crop1	15	166	32.4	9.34	0.91	9.74
Crop2	---	176	36.1	10.8	1.22	11.29
Crop3	--	174	40.8	11.1	1.32	11.89

In both the ecorace a significant increase in the cocoon weight was noticed from first crop to third crop. During the three crops the cocoon weight of Daba T.V was recorded 15.5,25, 21.6% more higher than Andhra local ecorace.The similar environmental conditions available for Andhra local ecorace and Daba T.V could not afford for similar cocoon weight in these ecoraces defining minimum environment influence and strain specificity. The previous reports on Bombyx.mori by Sen et al.,(1995) and in A.mylitta D(Daba, RF1, RF4, RF35, RS and Laria-8 and 15 crosses of these lines) by Siddiqui et al.,(1985,1988) have shown that cocoon weight is a heritable trait and the genetic advance in this trait is also high due to the additive gene action which governs this trait. The variability in the cocoon weight during the three crops for both the ecorace depicts high percentage of heritability and genetic advance in this character rather than environment influence.

In the experimental studies the average shell weight during first, second and third crops was increased from first to third crops in both the ecoraces. The shell weight values of Daba T.V cocoons were 2.2, 8.2 and 2.3% more than Andhra local depicting minimum influence of environment on this trait. Abdul bari (2000) working on the qualitative studies of Tasar cocoons reports that the shell weight of Daba T.V is higher than Andhra local ecorace. The findings of Siddiqui et al.,(1985,1988) in A.mylitta D and Sen et al.,(1995) in B.mori on shell weight proves the high % of heritability and genetic advance in this trait. With this it can be concluded that shell weight is a heritable character and both the ecoraces are genetically variable towards this trait.(Table-3).

Table: 3 Cocoon characters of *Andhra local* ecorace

Crop	Single cocoon reeled silk weight(g)	Single cocoon filament length (m)	Reelability (%)	Denier (%)	Effective rate of rearing (ERR %)
Crop 1	0.5	346.5	6.32	12.98	29.2
Crop 2	0.54	480.78	6.66	10.1	32.3
Crop 3	0.63	620.25	7.24	9.14	36.2

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Shell ratio found to be increased from first crop to the third crop in both the ecoraces. Even in similar environmental conditions the shell ratio values of Andhra local ecorace were found to be 13.5, 18.31 and 20% more than Daba T.V in all the three crops which can be correlated with the less environment influence on this trait and genetic variability between the ecoraces towards this trait. Shell ratio is a heritable trait and genetic advance for this trait is also high (Siddiqui et al., 1985, 1988; Sen et al., 1995). High shell ratio is the superior character of Andhra local ecorace among all other ecoraces of A.mylitta (Thangavelu, 1991 and 1992).

Single cocoon silk yield in Andhra local ecorace was found to be 24, 16.7 and 11.2% more than Daba T.V. from crop one to crop three. The production of higher silk yield during commercial crop was with better genotype and environment (G x E) interaction (Reddy et al., 2009)**.**According to Siddiqui et al.,(1988) working on A.mylitta D.(Daba, RF1, RF4, RF35, RS and Laria-8 and 15 crosses of these lines) have reported that silk yield is the heritable trait and it has genetic advance. Thus the variations in the values of silk yield under similar environmental conditions among the two ecoraces could be attributed to their genetic variability.

The present experimental studies show that the filament length of Daba is less by 26, 36.4 and 22.3% over Andhra local ecorace during the three crops. The previous findings of Thangavelu (1991, 1992) on wild silk moths have shown high filament length in Andhra local ecorace. In the available similar environment for Andhra local ecorace and Daba T.V, the longer filament of Andhra local ecorace can be attributed to its inherited superior trait and environment has less impact on it. Sen et al., (1995**)** working on B.*mori* reported the high percent of heritability and genetic advance in this trait governed by additive gene action.(table-4).

Table: 4 Cocoon characters of *Daba T.V* ecorace

Crop	Single cocoon reeled silk Weight(g)	Single cocoon Filament length (m)	Reelability (%)	Denier (%)	Effective rate of rearing (ERR %)
Crop 1	0.38	256.56	4.06	13.32	30.6
Crop 2	0.45	305.75	4.16	13.24	48.24
Crop 3	0.56	481.75	5.04	10.45	49.13

The present experimental study pertaining to the reelability of Andhra local cocoons represent 35.76, 37.54 and 30.39% more than Daba T.V. cocoons. Thangavelu (1991, 1992) working on wild silk moths concludes high reelability% in Andhra local ecorace. The variation in the reelability% values of Daba T.V and Andhra local ecorace in the similar environmental conditions explains the genetic control over reelability rather than the environment influence. In the present experimental studies lowest denier is attributed to Andhra local ecorace and it was less by 2.5, 23.7 and 12.5 over Daba T.V from first crop to the third crop.Thangavelu (1991, 1992) working on wild silk moths reported the low denier values in Andhra local ecorace. C.T.R and T.I Ranchi (1990) has observed that Andhra local cocoon has very important quality of having low denier which facilitates the production of finer fabrics of immense value. Under similar environmental conditions, Daba T.V and Andhra local exhibited a variation in their denier values. This implies genetic control over this trait rather than environment influence. In the present experimental studies the effective rate of rearing (ERR) for first, second and third crops of Daba T.V were 4.6,33 and 26.32% more than Andhra local ecorace and found to be increased from first crop to third crop in both the ecoraces. The susceptibility of Andhra local ecorace to various disease has decreased the ERR. The resistance to disease is strain specific by gene action **(**Reddy et al., 2010).The similar environmental conditions available for Daba and Andhra local ecorace could not generate similar percent of ERR for these two ecoraces.Sen et al., (1995) studying on B.mori has concluded that heritability as well as genetic advance were high for ERR percent and was governed by additive gene action. Thus, in conclusion, from the above work it can be mentioned that under similar environmental conditions like temperature, relative humidity and rainfall Andhra local ecorace has high percent of erratic emergence, fecundity,shell ratio, silkyield, filament length and reelability, and Daba T.V has more larval weight, cocoon weight, shell weight,high ERR and denier values which depicts genetic variations between the ecoraces.

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