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Research Paper

EFFECT OF MEDICINAL PLANT EXTRACT OF *Asparagus recemousces* AND *Astracantha longifolia* NERS AS FOOD SUPPLEMENT OF SILKWORM *Bombyx mori* L FOR IMPROVED COCOON TRAITS

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Abstract

Few plant extracts exhibits the presence of certain growth stimulants and can be used to increase the silk yield in commercial silkworm rearing. Present study reports effect of feeding mulberry leaves supplemented with *Asteracantha longifolia Ners.* Leaves and *Asparagus recemousces* roots extract daily and alternate day (at 1:50 and 1:100 concentrations) to silkworm larvae of *Bombyx mori*. Its effect on food consumption and utilization was studied to understand the efficiency of food conversion in to larval body during fifth instar. This include daily rate of food intake, digestion and excretion were recorded among supplemented treatments groups along with control group. Both medicinal plants namely,*A. longifolia Ners.* and *A. recemousces* treatments showed higher food consumption, food absorption, relative consumption rate (RCR), relative growth rate (RGR), approximate digestibility (AD), efficiency of conversion of ingested food (ECI) and efficiency of conversion of digested food (ECD) over control. However, the *A. longifolia Ners.* leaf extract at 1:50 concentration daily feeding recorded significantly higher food consumption and utilization parameters as food consumption (0.591gmdry wt./larvae/day), food absorption (0.256 gm dry wt./larvae/day), relative growth rate (0.033 gmdry wt./larvae/day), approximate digestibility (39.11%), efficiency of conversion of ingested food (24.15%) and efficiency of conversion of digested food (55.25%) as well as cocoon weight (1.59gm), shell weight (0.27gm), shell ratio (17.17 %), filament length (598.67 mtrs.), filament weight (0.16gm), denier (2.47), yield/10000 larvae brushed by number (9434.33) and yield/10000 larvae brushed by weight (15.12 kg) as compared with other treatment groups within and thatof *A. recemousces* and control, respectively, which may be due growth stimulating factors.

INTRODUCTION

Nutrition in the silkworm, *B. mori*L. directly influences the quality and quantity of production (Benchamin and Jolly, 1986). The share of mulberry leaves accounts more than 50% of the total cost of silkworm rearing (Trivedy and Nair, 1998) and remaining expenses on other aspects like silkworm seed, medicine and labour etc. The healthy growth of silkworm and ultimately the

economic traits such as larval characters cocoon and grainage parameters are influenced largely by the nutritional status of the leaves feed to the worms (Krishnaswami *et al.,* 1971). The silkworm does not grow properly if the nutrients and chemicals present in the mulberry leaf are less, and even if they grow they do not yield maximum output (Sengupta*et al.,* 1971). In addition to this, the silkworms that are underfed and those worms, which do not take proper nutrition, are less resistant to various diseases (Sidhu, 1968). The supplementation or Fortification of mulberry leaves is a recent technique in sericulture research (Murugan*et al*., 1998). Many attempts have been made by many workers to increase the nutritional quality of mulberry leaves by fortification of mulberry leaves, plant extracts (Jeyapaul*et al*., 2003), beneficial effects of chemicals (Bhattacharayya and Medda, 1981 a; 1983; Mujamdar, 1982; Gomma*et al*., 1976), hormones (Akapanthu, 1987; Garel, 1983; Singh 1991) and plant growth regulators (Agarwal, 1984; Kamada and Ito, 1984).
Silkworm larvae take up nutrients from mulberry leaves to build up body, sustain life and spin cocoon. The capacity of silkworm to ingest mulberry leaf, digest, absorb, assimilate and convert it to silk fiber differs from race to race. Studies on metabolism and energy requirements (Hibore*et al.,* 1978) and dry matter utilization (Hibore and Watanabe, 1983) have been worked out at various stages in silkworm *B. mori*L. The inter-strain differences in food utilization efficiency of indianmultivoltine and bivoltine breeds were also reported by Benchamin and Jolly (1986). Dietary efficiency study can be used as good tool to understand the way silkworm responds to different components of diets, environmental changes and exogenous administration of some components. The present study was undertaken to study the effect of *Asparagus recemousces* and *Astercantha longifolia Ners* on food utilization and cocoon characters of Silkworm *B. mori* L.

MATERIALS AND METHODS

The disease free layings of cross breed races (PM x NB_4D_2) were brought from NSSP Gadhhinglaj, Kolhapur, and Maharashtra. The *A. recemousces* roots and A. *longifolia Ners* leaves were collected from Agriculture Division, Central Research Station, BAIF, Uruli Kanchan, and Pune. The Asparagus roots and *A. longifolia Ner* leaves were shade dried and powdered. Plant extract was prepared in distilled water. 100g of plant material in 1000ml distilled water boiled up till 2/3 parts remained and were filtered. This solution was used as stock solution, which was further used to prepare dilution of 1:100 and 1:50 concentrations of each extract in distilled water. The mulberry leaves were dipped in different concentrations of plant extracts solutions for 10 minutes and fed to the worms during fifth instar. Further two groups are prepared one fed with treated mulberry leaves daily once and second fed with treated mulberry leaves on alternate day. The control was fed on normal leaves.
All the rearing operations were carried out according to Krishnaswami (1978). Three replications of 100 larvae each per treatment was maintained. Parallel batches of each treatment were also maintained to use it for the determination of daily equivalent dry weight of silkworm larvae. Similar provision was also made for an absolute control. Known quantum of mulberry leaves was offered to each replication three times a day taking utmost care to maintain the leaf moisture content to the maximum possible extent. Representative sample of mulberry leaf used for feeding was placed in separate trays in triplicate for determination of fresh-dry weight conversion factor. Five larvae were dried daily from parallel batches to constant weight and the fresh and dry weights were recorded to determine the conversion constant as well. Every subsequent day of feeding, the healthy and non-feeding/unhealthy larvae were removed. The litter was collected; excreta and unutilized leaf in the litter were manually separated from each other and oven dried to constant weights. Such dry weights were recorded. On maturation, the larvae were mounted for cocoon spinning. The cocoons were harvested on sixth day and counted batch wise. The cocoons in each batch were cut open and weights of cocoon and shell were recorded. All the consumption and growth parameters were measured on dry weight basis. The data on nutritional indices like food consumption, food absorption, relative consumption rate (RCR), relative growth rate (RGR), approximate

digestibility (AD), efficiency of conversion of ingested food (ECI) and efficiency of conversion of digested food (ECD) to biomass (Waldbaur, 1968) were worked out. The economic parameters such as cocoon weight, shell weight, shell ratio percentage, filament length, filament weight and denier, yield/10000 larvae brushed by number and yield/10000 larvae brushed by weight were also recorded.

RESULTS AND DISCUSSION

Variedresponse was recorded for the leaves of different quality, its growth being dependent on the efficient utilization and conversion of food in to silk substance by the silkworm from the same genetic stock (Gokulamma and Srinivasa Reddy. 2005). The data on growth parameters of silkworms fed on different concentrations of plant extracts has been presented in Table 1.1. Increase in ingesta, digesta and excreta per larva with advancement in age of silkworm in temperate breeds (Horie*et al.,* 1978; Jeksheva and Genova 1991), as well as in tropical breeds (Remadevi*et al.,* 1992), and its variations among breeds and seasons are well known on artificial diet and mulberry leaves (Yamamoto and Fujimaki, 1992). The result of food consumption that is ingesta was high in all the treatments compared to control. The lowest consumption was recorded in the plant extract at concentration 1:100 alternate day feeding group. Food consumption (ingesta) is a very important physiological and economic trait as far as sericulture is concerned. As ingesta refer to the quantity of leaf actually ingested by the silkworm, the quality of leaf offered has a direct bearing on this parameter. The less food consumption in the control category reflects the low silk production ability, as feeding influences the synthesis of total RNA and the translation of fibroin messenger RNA and DNA synthesis (Chavancy and Fournir, 1979). The diminishing conservation rate of less preferred food was partially compensated by increased assimilation efficiency (Soo Hoo and Fraenkel 1966). However, according to Mathavan and Muthukrishnan (1976) assimilation efficiency did not vary significantly as a function of reduced food consumption. Verma and Atwal (1963) observed that, feeding leaves supplemented with distilled water alone slightly increased the weights of larva, pupa and cocoon shell. The food absorption rates of all the plant extract treatments were superior over the control expect the *Asparagus recemoses* extract at concentration 1:100 alternate day feeding. Among the plants tested, the highest food absorption in the *A. longifolia Ner* extract at concentration 1:50 daily and alternate day feeding group was observed.

Relative consumption rate varied considerably in *Asparagus* and *Astracantha longifolia* plant extracts treatment. It was relatively higher in Asparagus treatment at 1:100 concentration with alternative day feeding of treated leaves followed by daily feeding of same (0.160 and 0.155 g dry wt./larvae/day). The rate of food consumption and leaf quality influence larval growth rate, weight gain and probability of survival significantly (Murugan and George, 1992). The relative growth rate (RGR) of all the plant extracts treatments was superior over the control. Higher growth rate (0.033 %) was observed for *A. longifolia Ner* treatment (1:50 concentration daily application). Approximate digestibility (AD %) is the ratio of the amount of food digested to the amount of food ingested in percentage. This parameter assumes much significance because the AD % the resistances of silkworm to disease incidence or variations in the environmental conditions are directly proportional (Trivedy, *et al.,* 2003). The approximate digestibility of all the plant extracts treatments was superior over the control and higher approximate digestibility (39.11 %) was observed in for *A. longifolia Ner* treatment on 1:50 concentration daily application. The higher value of approximate digestibility indicates the greater suitability of food plants. The narrow differences in AD amongst the treatments in the present work indicate that any variation in digestion capacity and ingestion was corresponding to each other and so the ratio between them and their percentage as depicted in result are only in normal range. The ingesta and digesta required to produce dry gram weight were low in young instar and increased gradually. It is evident that in young instars, the approximate digestibility and rate of assimilation of food were high compared to late instars. This is due to superior quality and high water content in the feed, which has a direct regulation on the phagostimulation, digestion and efficiency of conversions (Paul *et al.,* 1992). It is established that the water content of the feed has direct regulation over the ingestion, AD, ECI and ECD (Waldbaur, 1968 and Paul *et al.,* 1992). The growth of silkworm larvae mainly dependent on the efficiency of conversion of the food material to the body matter (Soo Hoo and Fraenkel, 1966). The efficiency of conversion of ingested food (ECI) and efficiency of conversion of digested food (ECD) of all the plant extracts treatments were superior over the control. The higher ECI (25.61 %) was observed in for *A. longifolia Ner* treatment on 1:50 concentration daily application, higher ECD (67.82 %) was observed in for *A. longifolia Ner* treatment on 1:50 concentration applied daily. The efficiency of conversion of ingested food is an overall measure of the ability of larvae to utilize the ingested food. Gokulamma and Srinivasa Reddy (2005) recorded higher ECD and ECI in the favorable season post-monsoon for V-1 mulberry variety.

Plant extracts show marginal tendency to improve many of the economic characters such as cocoon weight, pupal weight, shell weight and shell percentage (Murugan*et al.,* 1998). The result on the influence of plant extracts on important cocoon characters are presented in Table 1.2. Cocoon weight is a principle commercial character and shell weight is more important than cocoon weight because it is the shell that yields silk for rearing (Krishnaswamy*et al.,* 1988). Cocoon weight of all the plant extract treatments recorded significant increase over the control. The highest cocoon weight was recorded in *A. longifolia Ner* on 1:50 concentration daily application (1.59) and the lowest cocoon weight in plant extract treatments was recorded in Asparagus on 1:100 concentration alternate day applications (1.44). Shell weight of all the plant extract treatments recorded significant increase over the control. Cocoon shell weight is a commercial parameter correlated with the amount of silk output and leaf consumed by larva (Trivedy and Nair, 1998). The highest shell weight was recorded in *A. longifolia Ner* on 1:50 concentration daily application (0.27) and the lowest weight in plant extract treatments was recorded in Asparagus on 1:100 concentration alternate day applications (0.22). Significant increases have been shown for cocoon shell ratio in all the plant extract treatments over the control. The highest shell ratio was recorded in *A. longifolia Ner* on 1:50 concentration alternate day application (17.61) and the lowest shell ratio in plant extract treatments was recorded in Asparagus on 1:100 concentration alternate day applications (15.49). The filament length and filament weight in all the plant extract treatments recorded significant increase over the control. Highest filament length and filament weight was shown in *A. longifolia Ner* on 1:50 concentration daily application (598.67, 0.16). The high values of denier were observed in all the plant extract treatments than the control. Highest denier was shown for *A. longifolia Ner* on 1:50 concentration daily application (2.47). However, lower denier was recorded for Asparagus on 1:50 concentration daily application and *A. longifolia Ner* on 1:100 concentration daily applications than control. Jeyapaul *et al.,* 2003 and Sreenivasagaperumal *et al.,* 1995, also reported increase in the cocoon weight, cocoon shell weight, shell ratio percentage.

The study indicated that the plant extracts exhibits the presence of certain growth stimulants and can be used to increase the silk yield in commercial silkworm rearing. The *A. longifolia Ner* leaf extract at 1:50 concentration fed daily recorded higher food consumption and utilization parameters as well as the cocoon parameters from all the treatments so as the *A. longifolia Ne r* leaf extract at 1:50 concentration daily. One feeding may be recommended to the sericulturists to promote the economic characters like cocoon weight, shell weight, shell ratio, filament length, filament weight and denier.

Table 1.1. Effect of medicinal plant *A. recemousces* and *A. longifolia Ner* extracts on growth parameters of silkworm *B. mori L.*

Plant tested	Conc. of plant extract	Food consumption (gms. dry weight/ larva/day)	Food absorption (gms. dry weight/ larva/day)	RCR (gms. dry weight/ larva/day)	RGR (gms. dry weight/ larva/day)	AD %	ECI %	ECD %
Control		0.51 ± 0.166	0.178 ± 0.115	0.13 ± 0.022	0.024 ± 0.014	35.47	16.83	46.58
A. recemousces	1:100 daily	0.513 ± 0.158	0.198 ± 0.127	0.155 ± 0.025	0.026 ± 0.009	35.87	17.04	47.25
	1:100 alternat	0.505 ± 0.185	0.178 ± 0.132	0.16 ± 0.031	0.025 ± 0.014	35.65	16.95	46.4
	1:50 daily	0.538 ± 0.188	0.228 ± 0.126	0.13 ± 0.014	0.03 ± 0.010	36.45	20.24	51.15
	1:50 alternat	0.529 ± 0.192	0.222 ± 0.130	0.142 ± 0.021	0.027 ± 0.015	35.95	19.34	49.95
A. longifoliaNer	1:100 daily	0.57 ± 0.178	0.239 ± 0.121	0.128 ± 0.013	0.028 ± 0.009	38.05	21.35	51.58
	1:100 alternat	0.565 ± 0.190	0.235 ± 0.134	0.131 ± 0.012	0.027 ± 0.011	36.67	20.65	50.85
	1:50 daily	0.591 ± 0.190	0.256 ± 0.133	0.132 ± 0.011	0.033 ± 0.008	39.11	24.15	55.25
	1:50 alternate day	0.587 ± 0.171	0.245 ± 0.140	0.136 ± 0.015	0.032 ± 0.018	38.43	22.3	52.45

RCR - Relative consumption rate, RGR - Relative growth rate, AD - Approximate digestibility, ECI - Efficiency of conversion of ingested food and ECD - Efficiency of conversion of digested food.

Table -1.2. Effect of different medicinal plant *A. recemousces* and *A. longifolia Ner* extracts on post cocoon parameters silkworm *B. mori (PMX NB4D2)*

Groups	Treatments	Cocoon weight (gms)	Shell weight (gms)	Shell ratio %	FilamentLength (mtrs)	Filament weight (gms)	Denier	Yield/ 10000 larvae brushed by number	Yield/ 10000 larvae by weight (kgs)
Control		1.43	0.20	14.29	514.67	0.14	2.42	9327.00	13.40
A. recemousces	1:100 daily	1.49*	0.25**	16.88**	518.00	0.14	2.42	9366.00**	14.01*
	1:100 alternate	1.44	0.22*	15.49*	522.00	0.14	2.43	9346.67*	13.58
	1:50 daily	1.49*	0.25**	16.69**	530.00*	0.14*	2.41	9383.00**	14.11*
	1:50 alternate	1.49*	0.24**	16.05**	535.00**	0.15**	2.46	9365.00**	14.03*
A. longifolia Ner	1:100 daily	1.53**	0.24**	15.98**	541.00**	0.14**	2.40	9397.67**	14.52**
	1:100 alternate	1.49**	0.25**	16.63**	552.00**	0.15**	2.44	9385.67**	14.12*
	1:50 daily	1.59**	0.27**	17.17**	598.67**	0.16**	2.47	9434.33**	15.12**
	1:50 alternate	1.50**	0.26**	17.61**	569.67**	0.16**	2.45	9417.00**	14.30*
CD at 5%		0.030	0.012	0.609	15.399	0.006	0.018	19.008	0.309
S. E.		0.010	0.004	0.203	5.133	0.002	0.006	6.336	0.103

** Significant (P<0.05), ** Significant (P<0.01),* t test control vs. treatment.

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