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Effect of Feeding *Mikania micrantha* Leaves on the Amino Acid Concentration of Silk Fibre of Eri Silkworm *Samia ricini* Donovan.

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ABSTRACT

Impact of feeding of Japanese weed leaves *(Mikania micrantha)* on amino acid concentrations of silk fiber of eri silk worm, *Samia ricini* Donovan has been investigated. The larvae were reared on four experimental treatments (Ex tr. 1 – host plant. *Mikania micrantha* from 1st instar till maturity; Ex tr. II – host plant - *Ricinus communis* from 1st to 4th instar larva, the 5th instar larva fed on *Mikania micrantha & Ricinus communis* in equal proportion till maturity; Ex tr. III – the host plant *Ricinus communis from* I to II instar larvae. III instar larvae fed on *Mikania micrantha* till maturity*;* Ex tr.IV – the host plant *Ricinus communis* - the control). The major amino acid contents (alanine, glycine, serine, and tyrosine) of the fiber were studied . The highest concentrations of Alanine (45.41±1.33), Glycine (27.66±2.55) Serine (6.86±0.20) and tyrosine (4.56±0.19) were recorded in Ex.tr-l1l, Ex.tr-l Ex.tr-IV (control) and Ex.tr-l1l respectively. Thus, there is a great scope in feeding of *Mikania micrantha*, a widely available weed for rearing the worm for silk production commercially.

KEY WORDS: *Mikania micrantha, Samia ricini, Ricinus communis* and Amino acid.

INTRODUCTION

There are number of plants which are having Insect Growth Regulatory (IGR) activity, used in higher concentrations they are detrimental to the insects but useful at lower concentrations particularly for productive insects (Mane and Patil, 2000a). The weed plants are being tried to increase the silk and egg production in mulberry silk worm *Bombyx mori* as well as eri silk worm, *Samia cynthia ricini* Bois. Shivkumar *et al*, 1995 reported weed plant Cassiatora extracts in accelerating the maturity of *Bombyx mori*. Similarly, dusting of *Lantana camara* and *Clearodendron inermae* at 5% has increased silk and fecundity by eri silk worm (Mamadapur, 1994 and Santosh Kumar, 1997). The leaves of weed plant *Mikania micrantha* had been found to have significant effect on growth, development and yield of eri silk worm, *Samia cynthia ricini* Donovan (Devi , M., 2010). Further, among the 20 haemolymph free amino acid (FAA) glycine, alanine, serine and tyrosine are reported to being actively utilized for silk production in the sericigenous insects, *B. mori* (Tashiro *et al.*, 1968 ; Bose *et al* .,1989), *Antheria mylitta* (Jolly *et al.*,1972) *and Philosoma ricini* (Singh and Singh , 1984b). In the present investigation, an attempt has been made to know the effect of Japanese Weed *Mikania micrantha* on the major amino acid concentrations of silk fiber of eri silk worm, *Samia cynthia ricini* Donovan.

METHODOLOGY

Fresh disease free layings (dfls) of Eri silkworm were reared in the laboratory at temperature 22 ± 3 and 78 ± 4% RH. The egg incubation and rearing was undertaken as per the recommended method of Chaudhury (1982a). Four experimental treatments were developed with different food plants of *Mikania micrantha* and *Ricinus communis* ; Experimental tr-I- (Host plant *Mikania micrantha)*; Experimental tr- II (Host plant *Ricinus communis from* I to IV instar larvae. The V instar larvae fed with *Ricinus communis* and *M. micrantha* in equal proportion) ; Experimental tr-III (Host plant plant *Ricinus communis from* I to II instar larvae. III instar larvae fed with *Mikania micrantha* till maturity). Experimental tr-IV(Host plant *Ricinus communis* considered as control). Amino acid composition of *Samia ricini* polypeptides in silk fiber is determined by fractionated gel electrophoresis at acid pH in 4M urea (Mole %) according to the method of Lucas and Rudall, 1968.

RESULT AND DISCUSSION

From the study it has been revealed that in spite of heavy mortality (90%) of 1st instar larva in Ex tr.- I, the survivors (10%) were highly adapted to the new environment of food plant *Mikania micrantha*. The composition of major amino acid contents alanine, glycine, serine, and tyrosine varies significantly ($P<0.05$) among the different treatments as shown in the table. Comparatively higher alanine (45.41±1.33) was recorded in *Mikania micrantha* fed larvae from III instar onward followed by in *Mikania micrantha* fed larvae from I instar onward (45.01±1.45), control (44.67±1.43) which did not differ significantly. The lowest percentage composition of alanine (39.97±1.78) was recorded in the larvae fed with mixed food (*Mikania micrantha* and *Ricinus communis)* during V instar developmental period which differ significantly from Ex.tr-l, Ex.tr-l11, and control.From the table it is observed that the percentage composition of Glycine registered highest (27.66±2.55) in *Mikania micrantha* fed larvae from I instar till maturity (Ex.tr-l) and lowest (23.79±2.51) in mixed food (*Mikania micrantha* and *Ricinus communis*) fed larvae during V instar developmental period . Glycine percentage composition of Ex.tr-l1l (27.17±2.37), and Ex.tr-IV (26.46±2.16) placed second and third place respectively which did not differ significantly. The highest value of Serine is

recorded in control group of larvae (6.86±0.20) followed by Ex.tr-l1l (6.83±0.24), Ex.tr-l (6.80±0.26) which did not differ significantly. The lowest value of serine was recorded in Ex.tr-ll (6.19±0.39) which differ significantly (P<0.01) with other treatments. Significantly higher amount of tyrosine was recorded in Ex.tr-lll (4.56±0.19) followed by Ex.tr-l (4.54±0.18), control (4.21±0.05) and Ex.tr-lll (3.78±0.08). The CD values in respect of treatment effect in the table indicates that the effect of food plants in Ex.tr-l, Ex.tr-lll and Ex.tr-lV on the amino acid contents is statistically similar as no significant differences could be detected.

Table : Major amino acid percentage composition in the silk fibre of eri silk worm fed on different food plants (*Mikania micrantha*, *Ricinus communis* and their combinations).

Treatments		Amino acid (in terms of percentage)			
		Glycine	Alanine	Serine	Tyrosine
Ex.-tr. I	Mean	27.66	45.01	6.80	4.54
	S.E±.	2.55	1.45	0.26	0.18
Ex.-tr. II	Mean	23.79	39.97	6.19	3.78
	S.E.±.	2.51	1.78	0.39	0.08
Ex.-tr. III	Mean	27.17	45.41	6.83	4.56
	S.E.±.	2.37	1.33	0.24	0.19
Ex.-tr. IV (Control)	Mean	26.46	44.67	6.86	4.21
	S.E.±.	2.16	1.43	0.20	0.05
Average	Mean	26.27	43.78	6.67	4.27
	SE±.	1.16	0.84	0.14	0.09
CD at 5%		1.63	1.77	0.23	0.25
CD at 1%		1.95	2.25	0.29	0.32

The silk fiber protein is synthesized by silk gland cells and stored in the lumen of the silk gland. A very high concentration of amino acid (aminoacidemia) is a characteristic of insects. Every species shows great modification of its aminoacidemia during its development particularly during metamorphosis. Among the sericigenous insects, such as *B. mori*, as the development progress, the role of amino acid metabolism in the organism increases (Filippovich and Kafedry, 1962). It is established that all the silk fiber contains the major sericigenous amino acids such as glycine, alanine, serine and tyrosine. A number of workers have contributed to the study of the ontogenetic changes in the concentration of these free amino acids in haemolymph of sericigenous insects particularly during V larval instar due mainly to their involvement in silk protein synthesis in the silk gland.

Parenti *et al.* (1985) observed that in *P. ricini* the haemolymph is enriched with glycine, alanine, serine and tyrosine. The present work on *Samia ricini* Donovan highlights the sericigenous amino acids in silk fiber. Of these four amino acids, the concentration of alanine was found to be highest in all the experimental treatments, this is clearly evident in respect of female. Expectedly, the concentrations of alanine, glycine, serine and tyrosine were clearly lower than those of their male counterparts. Decrease of amino acid obtained in silk fibre from female larvae may be attributed to their utilization in egg production. On the other hand, the amount of glycine, next to alanine, was higher than serine and tyrosine; it is evident in both the sexes. Comparatively high alanine content and low glycine have also been observed in Saturniids by Lucas and Shaw in 1960. Wang and Xu (1982) suggested that alanine is biosynthesized in saturniidae from glutamate and glycine through transamination. However, the variation in tyrosine concentration may be related to the protein tanning and melanization of new cuticle (Duchateau-Bosson et al., 1962). Therefore, it may be concluded that in *Samia ricini*, high alanine

content may be the characteristic of the family sturniidae to which it belongs.

It has been reported that the silk thread fibrion of *Samia ricini* contain 47.9% of alanine, 31.4% of glycine, 5.10% of serine, and 5.56% of tyrosine (Rajkhowa, 1997). In *A. assama* on the other hand it contains 34.34% of alanine , 25.55% of glycine, 7.88% of serine , 4.61% of tyrosine (Anon, 1979), while in *B. mori* it contains 43.7% of glycine, 28.8% of alanine , 11.9% of serine and 5.1% of tyrosine (Shimura, 1988). In our present study on *Samia ricini* Donovan it has been observed that the concentration order of these four amino acid are alanine> glycine > serine > tyrosine (Table).

The variation in the concentration of these amino acids may be related to the amino acid contents of the food leaves of the silkworms. This view conforms with that of Inokuchi (1970) who suggested that the variation in free amino acid concentration may be due to the dietary amino acids which play an influential role in the concentration of the haemolymph amino acids. Further, it has been reported by various workers that some weed plants influence the growth and metabolic activity of silk gland in sericigenous insects (Mane & Patil, 2000a & b ; Mamadapur, 1994 & Santoshkumar, 1997**).** In the present investigation, the improvement of alanine, glycine, and tyrosine in the larvae fed with *Mikania micrantha* from III instar till maturity were 1.65%, 2.68% and 8.31% over control. The increased amino acid concentration in silk fiber may be due to *Mikania micrantha* for its role on growth and metabolic activity in the silk gland of *Samia ricini* Donovan. Thus, there is a great scope in feeding of *Mikania micrantha*, a widely available weed all over for rearing the eri silkworm for silk production commercially.

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