P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-3* ISSUE-6* September- 2018
E: ISSN NO.: 2455-0817 *Remarking An Analisation*

Bioefficacy of Invasive Species Mikania Micrantha with Reference to Polyphagus Worm *Samia Ricini* Donovan

Mainu Devi
Assistant Professor,
Deptt.of Zoology,
Diphu Govt. College
Assam, India

Abstract

Mikania micrantha kunth ex H.B.K. is one of the 100 world's worst alien species and pose a serious threat to biodiversity and ecosystem. *Mikania micrantha* has been using as a traditional medicine in different parts of the world over the years. In this paper the Foliar constituents of *Mikania micrantha* and the impact of feeding *Ricinus communis* fortified with different concentrations of leaf extracts of *Mikania micranhta* on silk quality parameter of eri silk worm have been investigated. Thus, *Mikania micrantha* a commonly available weed all over can be commercially exploited for better growth and silk yield of Eri silkworm.

Keywords: *Mikania Micrantha, Invasive Species, Samia Ricini, Foliar Constituents, Silk Quality.*

Introduction

Biological invasion is one of the major threats to native Biodiversity and Ecosystem. *Mikania micrantha* ex H.B.K., commonly known as Bitter Vine, a perennial weed of the Order Asterales, Family Asteraceae, has been listed as one of the 100 worst invasive alien species in the world (Lowe *et al.*2001). It is known for its vigorous and rampant growth grows best where fertility , organic matters , moisture, humidity are all high. Mikania causes a major menace in natural forests, agricultural systems specially tea , rubber and other plantation crop in North East and Southwest India (Sankaran and Sreenivasan, 2001). Mikania debris incorporated into soil was also shown to inhibit germination and seedling growth in some crops.

Although this plant is well known invasive weed spread throughout North East Region of India; it possesses various kinds of phytoconstituents. Studies on Mikania has been shown to have allelopathic properties i.e. releases chemicals that can inhibit the growth of plants. Li-ying, Guang-Yan, Chen, Peng and Li- Flanglan (2007), while studied on energetic cost of *Mikania micrantha* leaves observed that a variety of secondary metabolites like Phenolics, Flavonoids, Alkaloids and Terpens can be released by volatilization, lixiviation of aerial parts and decomposition of plant debris in the soil. The investigatory works of Singh and Benchamin (2002) on various botanicals suggest that many secondary metabolites such as phenolics, Glycocides, Alkaloids, Terpenoids, etc. that occur in plants exhibiting variation in quality as well as quantity operating as specific olfactory and gustatory stimuali. It is further established that the weed plants such as *Cassia tora, Lantana camara, Clerodendron inermae, Tribulus terrestris, etc*. release these metabolites and 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. At lower concentrations these secondary metabolites increase the larval and cocoon characters and thereby silk yield in both eri and mulberry silkworm (Mane and Patil, 2000). These metabolites have stimulatory effect on protein synthesis in the silk gland during larval period , thus leading to the increased silk output in Eri and Mulberry silkworm . Moreover, there is still limited study on the nutritional properties of *M. micrantha* as a scientific evidence to prove its traditional uses. Keeping all this in view the present study has been undertaken to know the bioefficacy of *M. micrantha* and the effect of its feeding on quality parameter (Denier, Tenacity, Elongations and Defective Cocoon percentage) of silk fibre of Eri Silkworm *Samia ricini* Donovan.

Review of Literature

There have been very limited studies across the globe on impacts of invasive plant species on native flora and fauna.Waterhouse and Mitchell (1998), reported that *Mikania micrantha* interferes with soil nitrification process. Chen, B.M., Peng, S.L. and Ni, G.Y. (2009) demonstrated the effect of the invasive plant *Mikania micrantha* H.B.K. and soil nitrogen availability through allelopathy in South China. A project on 'Impact of *Mikania micrantha* on Rhino population of Chitwan National Park, Nepal and its Control using Rust Puccinia spegazzini' was carried out by Niraj Prasad Koiralain in 2011. Another project on 'Effect of Mikania micrantha on the demography, habitat use and nutrition of greater one horned Rhinos in Chitwan National Park, Nepal' was carried out by Naresh Subedi in 2012. Harmful effects and chemical control of *Mikania micrantha* H.B.K has been investigated by Shen ShiCai; Xu GaoFeng; Zhang FuDou; et al. in Yunnan, Southwest China (2013). A study on 'Invasive Plant Species in Indian Protected Areas: Conserving Biodiversity in Cultural Landscapes' was carried out by Ankila *et al*. (2013). Further, the effects of invasion by *Mikania micrantha* in the buffer zone of Chitwan National Park (CNP) of Nepal are well documented by Akriti Khadka in 2017.

Objective of The Study

The main aim of the present study is to know the the bioefficacy of *M. micrantha* and the effect of its feeding on quality parameter (Denier, Tenacity, Elongations and Defective Cocoon percentage) of silk fibre of polyphagus Eri Silkworm *Samia ricini* Donovan..

Accordingly the objectives of the present study are as follows:

1. To study the Foliar constituents of *Mikania micrantha.*
2. To study the effect of feeding *Ricinus communis* fortified with different concentrations of leaf extracts of *Mikania micrantha.*

Hypothesis

Eri silkworm reared on *Ricinus communis ,* fortified with different concentrations of leaf extracts of *Mikania micrantha* has profound effect on the silk quality parameter of Eri silk worm *Samia ricini* Donovan. The presence of Secondary Metabolites enhances the larval and cocoon characters thereby a good quality yarn.

Materials and Methods

Preparation of Leaf Extracts

The healthy leaves of *Mikania micrantha* were collected from in and around of Diphu town, Assam. The methanolic extract is prepared from the shade dried and coarsely powdered leaves (250gm), using Soxhlet apparatus. The filtrate is evaporated in manually controlled conditions of temperature to prevent the denaturation of dissolved phytochemicals (Rota Vapour). In both cases either extraction or separation the maximum temperature is adjusted between 30–50°C; because at higher temperature, there may be the possibility of denaturation of secondary plant metabolites. Finally, the crude extract collected is subjected to Phtochemical analysis using Wagner's test for alkaloids, Zink Hydrochloride Test for Flavonoids, Ferric chloride test for phenols and Salkowski test for Terpenoids. All tests are done in triplicate.

Silk Quality of Eri Silk Worm

Immediately after hatching the larvae of Eri Silkworm was transferred to locally available red and white variety of castor leaves fortified with different concentration of extracts of *M. micrantha* leaves. A total eleven (11) treatments including control were fixed and replicated thrice with 100 larvae in each replication. An additional water control is also maintained simultaneously to know the treatment effect. The stock solutions were at first prepared by crushing 100gms. of *Mikania micrantha* leaves (cleaned with water) using an electrically operated grinder. This is considered as 100% (T_{100}) extract and another nine concentrations, 10% to 90% (T_{10}-T_{90}) were prepared from it using distilled water. The stock solutions were stored in refrigerator and fresh extracts were prepared in every 3 days. Leaf extracts was smeared on both sides of the castor leaves (*Ricinus communis*)at the rate of 4ml/sq.cm area, made shade dried, and were fed 4 times upto III instar and 5 times till the the larvae start spinning. Temperature was maintained at 22ºc ± 3ºc and relative humidity was maintained at 78±4% The cocoons were harvested on 6th day. silk quality parameter (Denier, Tenacity and Elongation at break) were recorded and subjected to statistical analysis.

Results and Discussions

The findings of the present study showed that the extract of *M. micrantha* possessed the following Secondary metabolites which has a strong bearing on silk quality parameter of Eri Silk Worm *Samia ricini* Donovan

Wagner's Test

The test solution has shown a reddish brown ppt. with Wagner's reagent indicated the presence of Alkaloids.

Zink Hydrochloride Test

The Test solution becomes red colour after few minutes with a mixture of Zink Dust and Conc. Hydrochloric acid indicated the presence of Flavonoids.

Ferric Chloride test

The Test solution has given blue green colour with Ferric Chloride indicated the presence of Phenols.

Salkowski test

The appearance of Yellow coloured precipitate indicated the presence of triterpenoides.

The treatment of Eri silk worm feeding with different concentrations of *Mikania micrantha* extracts had profound effect on physical characteristics of eri silk fibre, the findings on filament size, tenacity and elongation at break percentage are presented in the following Table. However, the data recorded in water control (WC) were found to be insignificant with absolute control (AC).

Denier

The finer denier (1.766±0.070) was recorded in the larvae treated with 40% (T_{40}) extracts of Japanese weed leave followed by control (1.819±0.061) and other treatments

Tenacity

As shown in the table significantly higher breaking strength or tenacity (3.880±0.150) in eri silk fibre was recorded in T_{40} followed by T_{30} (3.720±0.150), control (3.572±0.155) and other treatments, the lowest tenacity being recorded in T_{100} (3.205±1.150).

Elongation

Lowest percentage of elongation at break (24.033±1.383) was observed in T_{40} followed by T_{30} (24.096±1.396) T_{20} (24.378 ±1.465), control (24.383±1.452) and other treatments, the highest percentage being shown by T_{100} (25.154±1.531).

The biochemical test on determination of foliar constituents of *Mikania micrantha* revealed the presence of Alkaloides, Flavonoides, Terpenoides and Phenols. These are secondary metabolites act as specific olfactory and gustatory stimuali. In the present study, lower single cocoon filament denier, higher tenacity and lower elongation at break were recorded in the silk obtained from the larvae fed on 40% aqueous extracts of *Mikania micrantha* fortified on castor leave (1.766, 3.880 and 24.033 respectively) implies finer silk filament compared to the control and other treatments. The finer silk filament may be attributed to the increased protein synthesis particularly the fibrion synthesis in the posterior silk gland which in turn influences the fibre fineness. Significantly finer denier was recorded by mulberry silkworm fed on soyabean supplementation (2.72) and coarser denier (2.86) in control (Sundar Raj, Shinnaswami and Sannappa, 2000). The findings are in conformity with the findings of Santoshkumar, Rajashekharagouda and Mane (2000), who obtained lowest denier produced by the silkworm fed on mulberry leaves dusted with weed plant *Lantana camara*. The present observations are also in consensus with findings of Krishnappa (1987), Sridhar and Radha (1987) and Babu (1994) for their experiment with glycine supplementation in mulberry leaf. Similarly Eri silkworm reared on *Mikania micrantha, Ricinus communis* and their combination have profound effect on the silk quality parameter (Devi, M.2010). It is established that the weed plants such as *Cassia tora, Lantana camara, Clerodendron inermae, Tribulus terrestris, etc*. also release these metabolites and 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. At lower concentrations these secondary metabolites increase the larval and cocoon characters and thereby silk yield in both eri and mulberry silkworm (Mane and Patil, 2000). These metabolites have stimulatory effect on protein synthesis in the silk gland during larval period, thus leading to the increased silk output in Eri and Mulberry silkworm

Further, in the present investigation no defective cocoons in any case under laboratory condition were noticed which further prove better quality of cocoons, hence, better quality of silk fibre produced by eri silkworm reared with Japanese weed under different treatments.

Table-: Silk quality parameter of eri silkworm *Samia ricini* Donovan reared on fortified castor leaves with different concentrations of *Mikania micrantha* leaf extracts.

Concentrations	Denier (degummed)		Tenacity(g/den)		Elongation(%)	
	Mean±SE	CV%	Mean±SE	Cv%	Mean±SE	Cv%
10%	1.912±0.066	19.04	3.522±0.152	23.74	24.581±1.468	32.712
20%	1.911±0.064	18.58	3.572±0.152	23.70	24.378±1.465	32.919
30%	1.825±0.061	18.6	3.720±0.150	22.12	24.096±1.396	31.748
40%	1.766±0.070	17.69	3.880±0.154	21.94	24.033±1.383	31.53
50%	1.841±0.064	18.6	3.501±0.150	23.51	24.908±1.151	33.258
60%	1.922±0.065	18.68	3.501±0.150	23.51	24.992±1.532	33.59
70%	1.924±0.069	19.80	3.405±0.146	23.45	25.022±1.563	34.26
80%	1.918±0.070	20.07	3.405±0.146	23.45	25.068±1.546	33.79
90%	1.918±0.070	20.07	3.202±0.151	25.89	25.068±1.546	33.79
100%	1.927±0.069	19.86	3.205±1.150	25.71	25.154±1.531	33.35
Water control	1.806±0.061	18.72	3.584±0.154	23.60	24.381±1.452	32.61
Absolute control	1.819±0.061	18.58	3.572±0.155	23.80	24.383±1.452	32.63

Suggestion

There is still limited study on the nutritional properties of *M. micrantha* as a scientific evidence to prove its traditional uses. Hence, further investigation is necessary to study the Bioefficacy of *Mikania micrantha* that can be used as plant-based medicine.

Conclusion

The above observations have indicated that foliar constituents of *Mikania micrantha* have a strong bearing on quality of silk fibre of Eri silkworm and thus, it can be exploited for increasing the silk production commercially. As the mechanical control method of Mikania are labour intensive, expensive and not effective in longer term the biological control mechanism can help in controlling its spread to new regions and conserve biodiversity.

References

1. *Chaudhury, S.N.(1982), Eri Silk Industry, published by Directorate of Sericulture& Weaving, Govt.of Assam. , pp. 16- 114.*
2. *Babu, V.P. (1994) 'Influence of supplementation of L-glycine on parent silkworm, Bombyx mori L. and grainage, rearing and cocoon parameters during successive generation'. M.Sc. (Ser) Ph.D. Thesis, U.A.S., p.122.*
3. *Devi, M (2010) 'An Investigation on growth development and yield of silkworm Samia ricini reared on Castor and Japanese weed in Karbi Anglong District'. Ph.D. Thesis, Gauhati University, Assam (India).*
4. *Ilzuka, E.,(2000) 'Physical properties of silk thread from cocoons of various wild silk-moth including domestic silkmoth'. Int. J. wild silkmoth & silk. 5 : p266-269.*
5. *Krishnappa, J.B. (1987)' Influence of amino acid supplementation on growth and development of mulberry silkworm, Bombyx mori L.' M.Sc. Thesis (Seri) UAS, Bangalore, p.128.*
6. *Li-ying, N.,Guang-Yan, ,Chen B.M., and Peng,S.L.. (2007) 'Energetic cost of leaf construction in the invasive weed Mikania micrantha H.B.K. and its co-occurring species'. Botanical studies, 48 : 331-338.*
7. *Lowe,S., Brown, M.,.Boudjelas,S. and De Porter, M.(2001), '100 of World's Worst Invasive Alien Species: A selection from the Global Invasive Species' Database. The Invasive Species Specialist Group (ISSG) 12PP,.*
8. *Lowry, O.H.; Roserbrough, N.J.; Farra, L. and Randall, R.J. (1951) Protein measurement with the Folin Phenol reagent. J. Biol. Chem., 1933 : 265-275.*
9. *Mane, J.R., Patil, G.M.(2000) 'Effect of botanicals having IGR activity on growth & evelopment and economic Eri Silk worm, Samia Cynthia ricini boisd'. International Journal of wild silkmoth and silk, 5 : 200-203.*
10. *Narayanaprakash, R., Periaswami, K., and Radhakrishnan,S. (1985), ' Effect of dietary water content on food utilization and silk production in Bombyx mori L. (Lepidoptera : Bombycidae)'. Ind. J. Seric. 24 : p12-17.*
11. *Rajashekhargouda, R. (1991), 'Studies on methods to increase silk yield of Bombyx mori L. (Bombycidae: Lepidoptera)' Ph.D. Thesis, Tamil Nadu Agricultural University, Coimbatore: p 125-138.*
12. *Rajkhowa, R.(2000), 'Structure property correlation of non- mulberry and mulberry silk fibre'. International J. of Wild Silkmoth. Vol. 5: pp 287-298.*
13. *Sankaran, K.V., Sreenivasan, M.A. (2001) 'Status of Mikania infestation in the western ghat'. In: K.V.Shankaran, S.T. Murphy, H.C. Evans, eds. 'Allien weeds in moist tropical zones, bans and benefits', Kerela Peechi, India. Kerela Forest Research Institute. Pp.67-76.*
14. *Santosh kumar, G.H. , Rajasekhargouda and Mane(2000) 'Effect of dusting some plant products on quantitative and qualitative characters of Mulberry silk'. Bull. Acad. Ser 4(1) 75-77.*
15. *Singh, K. Chaoba, Benchamin K.V. (2002), 'Biology and Ecology of the Eri Silk moth, Samia ricini Donovan (Saturniidae): A Review' Bull. Ind. Acad. Seri. vol. 6 (1) :p 20-33.*
16. *Singh, K., Chaoba and Benchamin K.V., (2000) 'A Bibliography on ericulture. Central Muga and Eri Research & Training Institute, Jorhat, Assam. Eri Silk worm, Samia Cynthia ricini boisd'. International Journal of wild silkmoth and silk, 5 :p 200-203.*
17. *Sridhar, P. and Radha, N.V. (1987), 'Effect of supplementing glycine to the feed of silkworm Bombyx mori L'. (Mahalingam, S) Proc. Natl. Semi. Prosp. Prob. Seric.(March 27-30,1986), vellore, pp. 115-121.*
18. *Sundar Raj, S.; Chinnaswamy, K.P. and Sannappa, B. (2000),' Effect of feeding mulberry leaves fortified with protein supplementations on the productivity of silkworm, Bombyx mori L' Bull. Ind. Acad. Seri. 4(2) : p34-35.*
19. *Vasumathi, B.V., 'An analytical study of the silk reeling operation in Karnataka', Ph.D. Thesis, Indian Institute of Science, Bangalore, 2000.*
20. *Waterhouse, B.M., Mitchell, A.A. (1998) 'Nothern Australia Quarantine Strategy: weeds target list'. Second edition. Australian Quarantine & Inspection Service, Miscellaneous Publication NO.6/98.*