

New Record of Arthropod Fauna Associated with a Medicinal Herb, *Gymnema sylvestre* (R.Br) in Jaffna, Sri Lanka

S. Ahalya and G. Mikunthan

Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka

Abstract: Leaves of *Gymnema sylvestre* are traditionally used to treat diabetes mellitus. The presence of the fauna on the leaves may cause risk when consumed unnoticed with fresh leaves and they may have an effect on plant physiology as well as on phytochemical profile of the plant. Hence, it is important to study the arthropods associated with *G. sylvestre*. This study was conducted in a multiplication field of an acre area having 1300 plants and in household areas in Jaffna, Sri Lanka. 20 different arthropods were identified. Among them 15 were phytophagous viz: 5 Lepidopterans, *Euploea* sp, *Tirumala* sp, *Hannacapsia* sp, *Orgyia* sp, *Micronia* sp, 3 beetles *Chrysomela* sp, *Epilachna* sp and snout beetle (Curculionidae), a mite species (Tarsonemidae), an aphid *Aphis nerii*, a bug *Geocoris* sp, a grasshopper (Acrididae), a katydid *Neoconocephalus* sp, a mealybug (Pseudococcidae) and leafminer (Lepidoptera), 5 predatory species, *Monochilus sexmaculatus*, *Syrphus* sp, *Amblysius* sp and two spiders were found. Tarsonemid mite infestation caused the leaves to wither and shed subsequently and the damage was assessed as 47.26%. Lepidopterans were associated with 72% of sampled vines where as 52% plants were with sucking insects and 48% plants with leaf miners. This is the first report of fauna associated with *G. sylvestre* and it is expected to make awareness to the public especially the diabetic patients who consume raw leaves and for the industries prepare it in powder form. Further investigations on the presence of these faunal species and their impact on this medicinal plant have to be done.

Key words: *Gymnema sylvestre* • Damage • Fauna • Tarsonemid mite • Medicinal herb

INTRODUCTION

Gymnema sylvestre R.Br (Family: Asclepiadaceae) is a herb native to the tropical forests of southern and central India where it has been used as naturopathic treatment for diabetes for nearly two millennia [1]. In Sri Lanka, there are two varieties of *G. sylvestre* (Colombo and Jaffna) grown and are geographically differentiated. It is commonly used by the public and the Siddha Ayurvedic medical practitioners in indigenous medicine to treat diabetes mellitus. It has been identified as a nutraceutical compound with a complete functional food [2].

Leaves are the economic part of this medicinal herb. It is consumed as green leafy vegetables or as leaf powder. Nowadays several commercial products in different branded names such as Body slstto tea, Gymnema, Diet and sugar off are available [3]. During the years 2004 and 2006, the amount of *Gymnema* leaf powder

consumed as a functional food for diabetes has increased. Balasubramaniam *et al.* [2] reported that the production of *G. sylvestre* leaves is insufficient and unable to meet the increasing demands. It is obviously shown to increase the extent of the commercial cultivation of this potential medicinal herb to obtain sufficient amount of leaves. It is generally propagated through seed and stem cuttings. But one of the constraints in this conventional propagation of using seeds is very short span of seed viability.

G. sylvestre is a woody climber containing latex. Lactiferous plants suffer less from the herbivory than other plant species [4]. Similarly there is no pest outbreaks reported in this plant yet. But when this herb was commercially cultivated in a large area there are pest incidences notified. Eventhough initial infestation of insects and mites were in low numbers their population increased rapidly. Since the leaves are consumed directly there is no concern about the fauna associated with *G. sylvestre* until now even it possesses its importance in

ethnomedicine. This study was carried out in Jaffna after notifying the presence of different fauna in this herbal plant. It was mainly focused to study the presence of different fauna on *G. sylvestre* and to make awareness to the public and industrial people to alert the presence of them for a safer treatment in future.

MATERIALS AND METHODS

The study was carried out at a *G. sylvestre* field of an acre area having 1300 plants and households in Jaffna, Sri Lanka from April to December 2008 after notifying the presence of different fauna in this herbal plant. Jaffna District, the northernmost region of the Island of Sri Lanka situated within ten degrees of latitude to the north of the equator. In all it covers 2560 square km. The climate of this study area was with the mean average annual temperature of 28.04°C and precipitation of 150.98 mm.

Collection and Rearing: Randomly selected 100 plants were examined weekly for the presence of associated faunal species and the collected species were separated. All caterpillars found were identified to morphospecies and reared to adult stages in the laboratory. During their laboratory development, the dates of pupation, emergence of adults and all other traits of caterpillars were recorded. Field collected mites were reared under the laboratory conditions in Petri dishes with wetted blotting paper and in leaves [5].

Morphological Identification: Adults were identified by their morphological characters by comparing with museum specimens and using taxonomic key [6]. Mites were identified by examining the leaves under

stereomicroscope. Permanent slides were prepared for easy identification of this species. Field collected aphids were examined under stereomicroscope for their morphological features. Careful observations in field provided biological information. With the use of these information aphid was identified.

Damage Assessment: The mite damage on the leaves was assessed using a visual rating method and described in Table 1. Severity of damage was estimated using the following equation [7].

$$\text{Severity of damage} = \frac{\sum (\text{score} \times \text{number of damaged leaf})}{\text{Max score} \times \text{total damaged leaf}} \times 100$$

From 1300 plants, 25 plants were randomly selected of which 20 leaves/plant were again randomly selected and examined for mite infestation. Similarly they were used for assessing the defoliators, sucking pests, leaf miners and occurrence of spiders.

RESULTS AND DISCUSSION

This study aimed to make a preliminary inventory, through field collections of the insect and mite species occurring in the *G. sylvestre*. Pest attack in *Gymnema* is proportionately low when compared to other commercially cultivated plants. But nowadays the importance of this plant is increasing rapidly and the cultivation also changing into commercially based. Even though initial numbers of insects were low in this plant but they may rapidly increase when they are able to get their food abundantly. Concerning the importance of this medicinal plant this study gives awareness about the pest outbreaks in future.

Table 1: The characteristic damage of mite on the leaves and the corresponding visual rating

Infestation code	Characteristics	Interpretation
0	No damage	No infestation
1	Presence of few spots	Low infestation
2	Presence of spots in the leaf <25%	Medium
3	< 50%	High
4	<75%	Very high
5	Leaf full of spots and bronzed	Fully infested

Table 2: The characteristic damage of other fauna on the leaves and the corresponding visual rating

Characteristics	Indication
>3 leaves/randomly selected 20 leaves/ plant shows characteristic cutting	Defoliator- Lepidopteran pest occurrence. damage caused by Lepidoptera
>3 leaves/randomly selected 20 leaves/ plant shows crawling	Sucking pest occurrence- Aphid
>3 leaves/randomly selected 20 leaves/ plant shows folding	Spider occurrence
3 leaves/ randomly selected 20 leaves/ plant shows leaf miner attack	Leaf miner occurrence

Table 3: Identified Arthropod fauna in *Gymnema sylvestre*

Fauna	Common name	Order	Family	Scientific name
Defoliators				
Butterfly	Crow butterfly	Lepidoptera	Nymphalidae	<i>Euploea</i> sp.
	Blue tiger	Lepidoptera	Nymphalidae	<i>Tirumala</i> sp.
Moth		Lepidoptera	Pyrilidae	<i>Hannacapsia</i> sp.
	Tussock moth	Lepidoptera	Lymantridae	<i>Orgyia</i> sp.
		Lepidoptera	Uraniidae	<i>Micronia</i> sp.
Aphid	Oleander aphid	Hemiptera	Aphididae	<i>Aphis nerii</i>
Mite	Tarsonemid mite	Acari	Tarsonemidae	
	Predator mite	Acari	Phytoseiidae	<i>Amphyseius</i> sp.
Aphid predators	Lady beetle and larva	Coleoptera	Coccinellidae	<i>Menochilus sexmaculatus</i>
	Syrphid fly and larva	Diptera	Syrphidae	<i>Syrphus</i> sp.
Bugs	Mealy bug	Hemiptera	Coccoidea	
	Bigeyed bug	Hemiptera	Geocoridae	<i>Geocoris</i> sp.
Grasshopper		Orthoptera	Acrididae	
Conehead katydid		Orthoptera	Tettigoniidae	<i>Neoconocephalus</i> sp.
Leaf miner		Lepidoptera		
Beetles	Snout beetle	Coleoptera	Curculionidae	
		Coleoptera	Chrysomelidae	<i>Chrysomela</i> sp.
		Coleoptera	Coccinellidae	<i>Epilachna</i> sp.
Spiders	Small green spider	Araneae	Miturgidae	
	Crab spider	Araneae	Thomisidae	

Table 4: Damage assessment of mites in *Gymnema sylvestre*

Condition of infestation of mites on leaves	Percentage
No infestation	48.4
Low infestation	12.6
Medium infestation	15.0
High infestation	10.2
Very high infestation	7.6
Fully infested	1.4

During the survey, among the collected specimens 20 species of arthropods were identified. Of the 20 species, 15 were considered as plant feeders and the rest were potentially beneficial species. Based on the damage to plants and frequency of collection, only two of the 15 species (Tarsonemid mite and aphid) were considered pests of primary importance. Identified 20 species of Arthropods were given in Table 3.

The damage severity of Tarsonemid mite was estimated as 47.26%. Damage assessment of mites was described in Table 4. On a cross survey on the sampled vines, 72% of the plants were attacked by lepidopterans, 52% were attacked by sucking pests, 48% were affected by leaf miner and 48% leaves have exhibited association with spiders.

Among the species collected a phytophagous Tarsonemid mite was found in significant numbers. The Tarsonemid mites were very small and difficult to visualize through naked eye. Adult mites were elliptically shaped, but slightly wider at the front than the rear. Live specimens were light, translucent yellowish green. Dead

specimens were yellowish brown. They were fast moving. Larvae and adults preferred to feed on the undersides of leaves. These mite stages along with exuviae could also be consumed if proper cleaning process is not practiced while processing the leaves. Tarsonemid mite fed by sucking juices from the leaves resulting in a yellowish area at the point of feeding [8]. Moderate numbers of mites caused yellowish mottled appearance of the foliage noticeable only under magnification. More severe infestations can cause the plant or portions of it to turn yellow or brown and may even kill entire plants.

Aphis nerii was a bright yellow aphid insect. There were winged and wingless aphids were notified. Damaged leaves by aphids were accumulated with honeydew. They preferred new shoots and foliage, but in warm weather large colonies developed and they entirely affected the vines within a week. Its reproductive potential was high [9]. Population outbreaks did not occur suddenly but if left unchecked, large numbers can accumulate. Heavy infestations caused a greying or browning of the foliage and curling of the terminal branches. Large amounts of

honeydew which provided an excellent medium for the growth of a black fungus. Ants also fed on the honeydew. Besides being unattractive, sooty mold interfered with photosynthesis and retarded plant growth.

Aphid and mite populations fluctuated along to the temperature variations. Rainfall pattern severely affected the population density of these species. During the study, species of lady beetle and syrphid fly larva were found in association with aphids and further investigations showed that it was an efficient predator of aphids. They may believe to have kept aphids populations below the damaging level.

The reported caterpillars in *Gymnema* were free-living caterpillars, externally exposed on the leaves. Butterfly larvae are gregarious feeders. The presence of latex in the host plants seems to affect both the proportion of host plants with caterpillars (abundance) and the caterpillar species richness. Latex may work as a plant defense mechanism against insect herbivores [10].

CONCLUSION

Assessment of fauna associated with *G. sylvestre* revealed that there are 20 different fauna found associated with this medicinal herb, in Jaffna. Among them Tarsonomid mites and aphids were prevalent. Due to the small size, the presence of Tarsonomid mite would have been unnoticed and will be consumed by the public. This is the first report of fauna and these results would helpful to understand the fauna associated while collecting leaves to ensure clean leaves for the preparation by the public. Further investigation on the presence of these faunal species and their impact has to be done to understand the effect of their feeding on the quality of leaves of *G. sylvestre* and to avoid complications if consumed together with the leaves as unnoticed.

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