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Exploration of forest resource by both man and butterflies- a case study on utilization of medicinal plants as larval resource by nymphalinae butterflies

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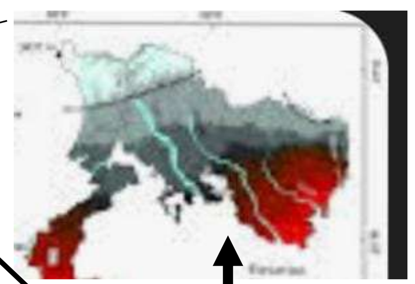
INTRODUCTION & AIM

Government of India has been actively promoting AYUSH (Ayurveda, Unani, Siddha and Homeopathy) in the healthcare sector and encouraging amalgamation of traditional systems with modern medicines. WHO has also acknowledged the contribution of traditional medicine practitioners. Phytochemical secondary metabolites (i.e. alkaloids, terpenoids, flavonoids, glycosides, tannins, sterols) forming the basis of medicinal framework also play crucial role in plant defence and ecological interaction with herbivores (i.e. butterflies). Olfactory and gustatory cues and their associated chemosensory mechanism of host plant identification at dual stages of their life cycle (i.e. larval feeding and oviposition) have been previously investigated.

Documentation of such therapeutically significant larval food plants of nymphalinae butterflies (Family: Nymphalidae) followed by recognition of their medicinal potential was undertaken across the Himalayan landscape of West Bengal, India.

STUDY AREA



The entire study was conducted across the districts of Darjeeling, Jalpaiguri, Coochbehar and Alipurduar across the Himalayan region of West Bengal, India

Map of the Himalayan districts of West Bengal, India

Map of West Bengal

METHOD

Study was carried out across the Himalayan landscape of West Bengal, India.

At the preliminary level, an ethnomedicinal survey based on informal face to face dialogue was conducted with local populace irrespective of their caste and religion with the aim to identify the most knowledgeable people (old, aged and experienced people, ojhas, kaviraj and vaidyas). Specially designed questionnaire was prepared for these folklore therapists and traditional healers. Group discussion and several informal meetings were also held as required. The traditional knowledge regarding folk therapy as imparted by these people were documented in data sheet. Significantly, no modification was made in the representation of information as provided by informants. Therapeutic benefits of such plants as proposed by these participants were later confirmed using published literature (Paria 2005). Plant samples were photographed and subsequently identified from published literature (Polunin & Stainton 1984; Press *et al* 2000; Manandhar 2002) along with the assistance from taxonomist. Such database was created for ascertaining the Informant Consensus Factor (ICF), Utilization Value (Uv) and Fidelity levels (FL).
Identification of butterfly species utilizing the same medicinal plants as their larval host plants constituted the final phase of this study. Importantly, such characterization of larval host plants was done with the assistance of published literature (Haribal 1992; Kehimkar 2002). Additionally the Host Plant Specificity (HPS) and Polyphagy Index (PI) were determined to reflect the importance of such medicinal plant species as larval resource of butterflies

Data Analysis:

ICF (Informant Consensus Factor): (Nur-Nt)/(Nur-1) where **Nur** refers to the number of use reports and **Nt** is the number of taxa used for a particular category by all informants.
FL (Fieldity level): Np/N where **Np** is the number of use reports cited for a given species for a particular ailment and **N** is the total number use reports cited for any given species.
Uv (Utilization values: **(∑Ui)/n** where **Ui** is the number of use reports cited by each informant for a given species and **n** refers to the total number of informants
Polyphagy Index of Butterfly Species (Polyphagy index is measured as PI=(AXB)½ where A= number of genera of host plants and B=taxonomic diversity of hosts (1=one plant species; 2=one plant genera; 3=one plant family; 4=one plant order; 5=two or more plant orders)
Larval Host plant Specificity in Butterflies (HPS) expressed as percentage of species that feed on only one species of plant, on one genus, one family, two families and three or more plant families respectively

FUTURE WORK / REFERENCES

Proper utilization of the knowledge of ethnic people along with conservation of such plants is essential. Similar strategies should also be designed for management of these plants serving as larval resource of butterflies.

RESULTS & DISCUSSION

From among 23 butterfly species, *Junonia lemonias, J. orithiya, Hypolimnas bolina* and *H. misippus* possessed highest HPS thereby exploring 3 plant families (Table 1). A maximum PI value was determined for *Junonia lemonias* (5.477) followed by *Hypolimnas bolina* and *H. missipus* (5.000) (Table 1).
Among 29 plant species, *Urtica dioca*, *Boehmeria glomerulifera, Hygrophila auriculata, Sida rhombifolia* and *Debreagesia velutina* possessed maximum ICF values of 1.00 indicating diseases of the digestive system and disorders associated with the respiratory system. Highest FL of 100% was noted for *Urtica dioica, Artemisia vulgaris, Dioscorea deltoides, Mimosa pudica* and *Hygrophila auriculata* thereby indicative of their usage for the treatment of single ailment. *However Elatostema sessile* (16%) and *Asytasia macrocarpa* (21%) represented plant species required for curing multiple illness (Table 2). *Hygrophila auriculata* (0.89) and *Urtica dioica* (0.87) reported their rich potential in the treatment of diseases. On the contrary, *Barleria prionitis* (0.17) was indicative of fewer reports with lesser benefits (Table 2).

Butterfly species	HPS	PI
Araschnia prorsoides (Blanchard)	1S	1.000
Symbrenthia niphanda Moore	1S	1.000
Symbrenthia hypselis (Godart)	1F	2.449
Symbrenthia hippoclus (Cramer)	1G	1.414
Vanessa indica (Herbst)	1F	2.449
Limenitis trivena Moore	1F	2.449
Vanessa cardui (Linnaeus)	2F	4.472
Aglais cashmiriensis Kollar)	1F	2.449
Aglais urticae (Linnaeus)	1S	1.000
Kaniska canace (Linnaeus)	2F	3.162
Polygonia egea (Cramer)	1S	1.000
Rhinopalpa polynice (Cramer)	1S	1.000
Junonia orithiya (Linnaeus)	3F	4.475
Junonia hierta (Fabricius)	1F	2.449
Junonia atlites (Linnaeus)	1F	2.449
Junonia iphita (Cramer)	1F	2.449
Junonia lemonias (Linnaeus)	3F	5.477
Junonia almana (Linnaeus)	2F	3.873
Hypolimnas bolina (Linnaeus)	3F	5.000
Hypolimnas misippus (Linnaeus)	3F	5.000
Kallima inachus (Boisduval)	1S	1.000
Doleschallia bisaltide (Cramer)	2F	3.162
Kallima alompra Moore	1S	1.000

Table 1

Plant species	Uv	F_L
Urtica dioica	0.87	100%
Urtica parviflora	0.74	54%
Girardinia heterophylla	0.66	62%
Elatostema cuneatum	0.22	25%
Elatostema sessile	0.21	16%
Laportea interrupta	0.61	55%
Debreagesia velutina	0.82	87%
Debreagesia wallichiana	0.77	79%
Boehmeria glomerulifera	0.80	82%
Hygrophila auriculata	0.89	100%
Justicia adhatoda	0.46	45%
Justicia procumbens	0.44	66%
Barleria cristata	0.28	72%
Barleria stigosa	0.46	64%
Barleria prionitis	0.17	42%
Nelsonia campestris	0.54	35%
Asystasia macrocarpa	0.44	21%
Strobilanthes capitatus	0.69	78%
Sida rhombifolia	0.72	89%
Hibiscus rosa chinensis	0.61	34%
Abelmoschus esculenta	0.53	44%
Portulaca oleracea	0.66	68%
Dioscorea deltoides	0.81	100%
Artemesia vulgaris	0.77	100%
Corchorus capsularis	0.42	35%
Gnaphalium affine	0.52	40%
Mimosa pudica	0.78	100%
Smilax glabra	0.26	75%
Erythrina vulgaris	0.34	56%

Table 2

CONCLUSION

A close relationship shared between larval stage of butterflies and the narrow range of their food plants (containing secondary metabolites) may be promoted by the evolution of a requirement amongst the butterflies to survive and succeed during different stages of their life. Additionally, polyphagy is known to provide a stimulus among butterflies enabling their sustenance through life history stages. Butterflies are known to sequester such unpalatable or toxic metabolites to enhance its defense against enemies. However, among the most commonly used drugs of modern medicine aspirin, digitalis, some anti-cancer and anti-malarial drugs have originated from plant sources (Grover *et al* 2002). Ethnobotany therefore serves as a tool for generation of several novel herbal formulations by utilization of the indigenous knowledge of the ethnic people.
Additionally the utilization of similar ethnomedicinally important plants by larval stages of butterflies calls for the use of these phyto resources by man in a judicious manner.