Role of Insect Biodiversity in Poverty Alleviation

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Insects are the most numerous form of animal life on the planet and can be found in every environment on our planet. Ten years ago there were approximately 750,000 named insect species. Today, that number is over 1,000,000. According to a recent article in Scientific American, entomologists estimate that there are likely over eight million different species of insects on Earth. When compared that to 4,650 named and 4,809 estimated mammal species or the 72,000 named and 1,500,000 estimated fungi, it is easy to see that insects "out-populate" any other living taxonomic group on Earth.

Insects have been associated with man's interest in many ways. Their ability to both benefit and harm to mankind makes this relation a unique one. Many insects are harmful to mankind as they feed on cultivated plants, act as vector of many plant and animal diseases and cause economic loss to various extents; these insects come under the category of pest. On the other hand insects perform a vast number of important functions in our ecosystem. They aerate the soil, pollinate blossoms, and control insect and plant pests; they also decompose dead materials, thereby reintroducing nutrients into the soil and help in reducing the losses to human being and his belongings. Along with these, some of the insects produce the precious materials, useful to man; silk, honey, wax, lac etc. Some insects also act as predator, parasitoid, and scavengers and help in reducing the losses to human being and his belongings. We describe below some of these aspects which have helped the humanity in earning their livelihood in the past and are playing key role in alleviating poverty in the rural and tribal areas of India and as a matter of fact, the whole world.

A. Sericlture

Silkworm is the common name for the silk-producing larvae of any of several species of moths. Silkworms possess a pair of specially modified salivary glands called silk glands, which are used in the production of cocoons. The silk glands secrete a clear, viscous fluid that is forced through opening, called spinneret, on the mouthparts of the larva; the fluid hardens as it comes into contact with air. The diameter of the spinneret determines the thickness of the silk thread produced.

The art of silk production is called **sericulture** that comprises cultivation of mulberry, silkworm rearing and post cocoon activities leading to production of silk yarn. Sericulture provides gainful employment, economic development and improvement in the quality of life of people in rural area and therefore it plays an important role in anti poverty programme and prevents migration of rural people to urban area in search of employment.

Species of Silkworms: There are four different species of moths, cocoons of which yield differing types of silk:

(1) **Mulberry Silk** is the most common among them contributing to nearly 95% of world's silk production. It is produced from the cocoons of the moth *Bombyx mori*. Within the species there are many varieties, mainly differentiated according to the number of generations produced annually under natural conditions. Then, hybrids of various kinds have also been developed. Multi voltine varieties (laying eggs several times a year) have been widely propagated to enhance the yields.

(2) **Eri** silk worm has two varieties - a wild one and a domesticated one bred on castor leaves. The filament is neither continuous nor uniform. Hence the moths are allowed to emerge before commencing reeling. A white or bright red silk is produced.

(3) **Tasar** silk worms are wild. The Indian Tasar worm feeds on trees of *Terminalia* species and other minor host plants, while the Japanese and Chinese worms feed on oak and other allied species. Reeling can be done as with mulberry worms.

(4) **Muga** silk worm is found only in Assam. It feeds on two local species of shrubs - *Machilus bombycina* and *Litsae polyantha*, producing a strong, golden yellow thread, very much liked by people in Assam.

Economics of sericulture:

1. High employment potential

1. 60 lakh persons are engaged in various sericulture activities in the country.
2. It is estimated that Sericulture can generate employment @ 11 man days per kg of raw silk production (in on-farm and off-farm activities) throughout the year. This potential is par-excellence and no other industry generates this kind of employment, specially in rural areas, hence, sericulture is used as a tool for rural reconstruction.

2. Low Gestation, High Returns

1. Estimated investments of Rs.12,000 to 15,000 (excluding cost of land and rearing space) is sufficient for undertaking mulberry cultivation and silkworm rearing in one acre of irrigated land.
2. Mulberry takes only six months to grow for commencement of silkworm rearing. Mulberry once planted will go on supporting silkworm rearing year after year for 15-20 years depending on inputs and management provided.
3. Five crops can be taken in one year under tropical conditions.
4. By adopting stipulated package of practices, a farmer can attain net income levels up to Rs.30000 per acre per annum.

3. Provides vibrancy to village economies

About 57 % of the gross value of silk fabrics flows back to the cocoon growers with share of income to different groups as under:-

1. 56.8 % to cocoon grower
2. 6.8% to the reeler
3. 9.1% to the twister
4. 10.7% to the weaver
5. 16.6% to the trade

Women friendly occupation

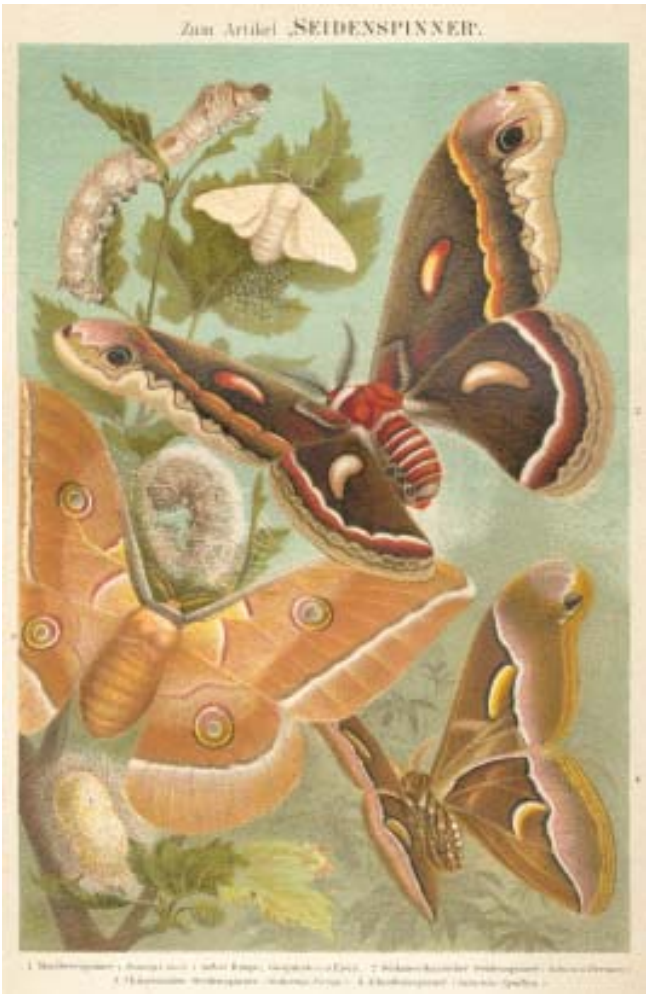
Women constitute over 60 % of those employed in down-stream activities of sericulture in the country. This is possible because sericulture activities starting from mulberry garden management to leaf harvesting and silkworm rearing is more effectively taken up by the women folk. Even silk reeling industry including weaving is largely supported by them.

Ideal Programme for Weaker Sections of the Society

- Sericulture can be practiced even with very low land holding.
- About ¾ acre of mulberry garden and silkworm rearing can support a family of three without hiring labour.
- Features such as low gestation, high returns make sericulture an ideal programme for weaker sections of the society.
- Vast tracts of forest based tasar food plantations available in the country, if judiciously exploited for rearing tasar silkworms, can offer supplementary gainful employment for tribals.
- Cases of landless families engaged in cocoon production using mulberry contracted from local farmers are common in some states.

Case study about success of Sericulture:

Konda Adinarayanappa, (52yrs) looks after both



Different species of silkworms

Coccinella septem-punctata feed ing on aphids

Chrysoperla carnea feed ing on aphids

Honey bee as an excellent poll inator

a

b

c

Fig. ***a :*** Crimson lac insect: body colour crimson, resin colour yellowish orange. ***b:*** Yellow lac insect: body colour changes to yellow, resin colour remains yellowish orange. ***c:*** Cream lac insect: both body as well as resin colour are creamish.

sericulture as well as agriculture and manages other activities in the village as an ex-president of the Panchayat. Adinarayanappa stated that sericulture yields in the village were responsible for encouraging the farmers to grow more silk worms. He has 5 acres of wetland and 4 acres of dry land and has been practising agriculture from the beginning. He used to produce paddy, Ragulu and groundnut earlier and now mulberry. In sericulture, he gets Rs. 9,900/- per crop and he uses 200 DFLs per crop. Quantity of cocoons he gets is 90 Kgs per crop. Average price per kg of cocoons is Rs.110/- (110 × 90= 9,900).

Following table shows the comparative yields of different crops in the village.

Comparative returns from different crops

Details of crop	No. of crops in a year	Annual income per acre (in Rs.)	Expenditure (in Rs.)	Net income per acre (in Rs.)
Groundnut	One to two	7,500	5,243	2,257
Ragulu	Two to three	12,000	3,600	8,400
Paddy	Two to three	20,500	6,075	14,175
Mulberry	Five to six	49,500	21,500	26,000

Source: Sericulture and Community Development in the context of Globalisation: an Empirical Evidence of a Village in 2005

B. Apiculture / Bee-keeping

Apiculture may be defined as rearing of honey bees for obtaining honey bee and other bee products. Beekeeping is one of the more universal agricultural endeavors. Bees are found on all continents, oustide of Antartica. Bees work a dual agricultural role by both producing honey and aiding in the pollination of flowering crops. Although much work and study has focused on improving the practice of beekeeping, or apiculture, it is still possible and prevelant to manage beehives at a very low level of technological and capital input. Their cosmopolitan distribution, multipurpose nature and relative simplicity in managment combine to make bees a natural agricultural supplement for many types of farm system in developing countries.

Species of honey bee

There are four common species of honey bee under a single genus *Apis*.

1. ***Apis dorsata* (The rock- bee)**- This is the largest honeybee. Builds single large open comb on high branches of trees and rocks. Produces large quantity of honey, but this bee is difficult to domesticate. This bee is ferocious, stings severely causing fever and sometimes even death.
2. ***Apis indica* (The Indian bee)**- Medium - sized. Hive consists of several parallel combs in dark places such as cavities of tree trunks, mud walls, earthen posts, etc. This bee is not so ferocious and can be domesticated.
3. ***Apis florea* (The little bee)**- small - sized. Builds single small combs in bushes, hedges, etc. Honey yield is poor.
4. ***Apis mellifera* (The European bee)**- Somewhat like the Indian bee (*Apis indica*).

Bee keeping provides :

(i) honey - a valuable nutritional food

(ii) bees wax - which has many uses in industry

(iii) Honey bees are excellent pollinating agents, thus increasing agricultural yields.

In terms of actual value this advantage exceeds the other two.

2. Dependence of some crops on insects for pollination is as under :

Sunflower	100 %	Lemon	20 %	Vegetable seed	100 %
Grape Fruit	80 %	Water Melon	70 %	Straw-berry	40 %
Pumpkin	90 %	Rape seed	100 %	Niger	100%
Safflower	100 %	Lime	30%		

Apiculture's role in poverty alleviation

When apiculture forms part of people's livelihood strategies there are various possible outcomes. Some of these outcomes will include income and material

goods, but also non-material outcomes such as well-being and contentment. In terms of apiculture, the least visible livelihood outcome is the pollination of flowering plants, both wild and cultivated: this is an outcome impossible to quantify. Honey is a traditional medicine or food in nearly all societies and whether sold in a simple way at village level or packaged more sophisticatedly , honey generates income and can create livelihoods for several sectors within a society. Beeswax is also a valuable product from beekeeping, although in some places its value is not appreciated. Industrialized countries are net importers of beeswax, and the supply comes from developing countries. The beekeepers and other people in a community can create further assets by using honey and beeswax to make secondary products, such as candles, beauty creams or beer. Selling a secondary product brings a far better return for the producer than selling the raw commodity. Bees also generate other products (pollen, propolish and royal jelly) that can in some situations be harvested, marketed and made into secondary products: all of this work effectively strengthening people's livelihoods.

C. Lac Culture

Lac is a resinous substance secreted by a tiny insect called *Lacciferlacca* (popular name "lac insect"). Shellac is the purified lac usually prepared in the orange or yellow flakes.

Lac or shellac is used in many ways

1. Commonest use is in polishing wooden furniture. The granules are dissolved in spirit and then are applied in very thin layers on the wooden surfaces.
2. In sealing parcels, packets and envelopes, in making phonograph records (now replaced by synthetic material)
3. In shoe polishes.
4. In toys and jewellery.

Lac is generally grown on host trees of Kusum (*Schleichera oleosa*), Palas (*Butea monosperma*) and Ber (*Zizyphus jujuba*) found abundantly in the forest of Jharkhand State. People residing inside the forest or in the fringe areas are depending completely for their livelihood on lac production. Factories making bangles, toffee for children and few medicine are purchase lac from local market through middlemen. Due to the lack of modern technologies forest farmers are cultivating it by traditional knowledge. Many NGO's and govt. agencies working in the field for rural development can play a big role in the arrangement of training by calling experts from research and training center for rural farmers and youth people.

D. Use of Insect Biodiversity as Bio-pesticides :

The deleterious effects of pesticides to man and his environment is well known. There are several examples of pesticides hazards. One of the important role, the bio pesticides are playing, is their ecofriendly nature. Here we quote some examples the ways these biopesticides are being used by the poor farmers for their agricultural production (income) at the same time conserving and maintaining the quality of the environment.

Use of insect biodiversity in control of terrestrial and aquatic weeds:

Many species of insects have been used to control aquatic weeds in large water reservoirs, ponds, lakes etc. The insects are reared and released in a very large number which feed on the weeds and clear the water reservoir used by the poor people for fisheries, and other aquatic activities. Likewise terrestrial weeds do create problems of cultivation particularly *Parthenium* and *Lantana*. The land could be successfully cleared for the purpose of cultivation provided the effort is made on a large scale.

Weed	*Controlled by (Insect)*
Opuntia spp. (Prickly pear)	*Cactoblastis cactorum*
Lantana camara (Lantana)	*Ophimyopia lantanae*
Parthenium hysterophorus	*Zygogramma bicolorata*
Eichornia crassipes (Water hyacinth)	*Neochatina bruchi*

Use of predatory and parasitic insects to control crop pests

Mass multiplication of parasitic and predatory insects and their release has helped controlling insect pests attacking different crops. This has helped the farmers to minimize the expenses of costly pesticides inputs and the inherent hazards due to their use. This eco friendly approach is cost effective and preferred by people over chemicals.

Insects- next to man- are the most successful animals on the earth. They affect the human being and his belongings in both ways (beneficially and harmfully). The beneficial part of insect biodiversity has gone to the extent of establishing the agrobased cottage industries by the people in rural areas. The export earnings further plays role in strengthening economy of the country.

Parasites	Target insects
Xanthopimpla punctata	stem borer
Apanteles flavipes	Rice Stem borer, Sugarcane top shoot borer
Aphelinus mali	Woolly apple aphid
Trichogramma spp.	Various pest of sugarcane, cotton and Rice stem borer
Campoletis chloridae	Helicoverpa armigera

Predator	Target insects
Coccinella septempunctata	Aphids
Menochilus sexmaculatus	Aphids, mealy bugs
Mantispa spp	Spider
Mantis religiosa	Aphids, grass hopper, wasp and spider
Chrysoperla carnea	Aphids