KFRI Research Report No. 286

Development of butterfly farming enterprises *vis-a-vis* conservation and sustainable utilisation of biodiversity

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November, 2006

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(Final Report of the project KFRI/365/2001 submitted to the Western Ghats Cell, Planning and Economic Affairs Department, Government of Kerala, March 2001 to March 2003)

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Abstract of Project Proposal

Project No. KFRI/365/2001

Title of the project: Development of butterfly farming enterprises *vis-a-vis* conservation and sustainable utilisation of biodiversity.

Objectives:

To set up an insectarium and butterfly house to facilitate education of the public on the significance of nature conservation.

To develop a centre to assist in the conservation of endangered species through captive breeding and reintroduction,

To provide the local communities direct incentives to conserve the butterfly habitats and the biodiversity found within, and

To explore the prospects of generating funds as well as spreading the conservation message through sale of curios, souvenirs, mementoes etc.

Date of commencement: March 2001

Scheduled date of completion: March 2004

Project team

Principal Investigator: Dr. George Mathew

Study area: KFRI Sub Centre, Nilambur

Duration of the study: Three Years

Project budget: Rs. 7,50,000 -

Funding agency: Department of Planning and Economic Affairs (Western Ghats Cell, Government of Kerala)

Contents

Abstract

The prime objective of this project *viz.*, setting up of an insectarium and butterfly house to facilitate education of the public on the significance of nature conservation could not be achieved due to various administrative reasons. Therefore, the project had to be limited to setting up a of a butterfly garden which was established in the KFRI Sub Centre Campus at Nilambur. The garden was a great success in that about 50 species of butterflies were sighted annually, some of which developed into local populations. Eight species recorded in this study are protected under the Indian Wildlife (Protection) Act and six species are Western Ghat endemics. The most spectacular result was the multi species aggregation of danaine butterflies (*Danaus genutia, D. chrysippus, Tirumala limniace, T. septentrionis* and *Euploea core*) on *Crotalaria retusa* during the months June to November with 30-40 butterflies roosting per plant. Exhibits depicting butterfly life stages were set up in the garden for providing information on the life of butterflies. Information pertaining to the general requirements for setting up a butterfly farm along with a brief discussion on the problems and prospects of this enterprise is also presented.

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Fig. 1

Fig. 2.

Fig. 1. Main entrance to the garden
Fig. 2. Nature trail

Fig. 1.

Fig.2.

Fig. 1. Cascade
Fig.2. Model of Southern Bird Wing

Fig. 1. View of a pond set up in the garden

Fig. 2. Photo-voltaic system set up in the garden for circulation of water through ponds and streams

Plate I. General view of Butterfly Garden

Fig. 1

Fig. 2.

Fig. 1. Main entrance to the garden
Fig. 2. Nature trail

Plate II. General view of Butterfly Garden

Fig. 1.

Fig.2.

Fig.1. View of cascade
Fig.2. Model of danine butterfly aggregation on *Crotalaria retusa*

PLATE III- General view of butterfly garden

Fig. 1.

Fig. 2.

Fig. 1. View of a pond set up in the garden. In the background is a model of Gram Blue (*Euchrysops cnejus*) in courtship.

Fig. 2. Photo-voltaic system set up in the garden for circulation of water through ponds and streams

I. Introduction

Butterflies are among the most beautiful organisms in the universe, which have fascinated naturalists for centuries. There are approximately 20,000 species of butterflies distributed throughout the world. India, with its diversified ecosystems ranging from the snow-clad temperate forests in the Himalayas to the tropical wet evergreen forests of the Western Ghats, has a rich butterfly fauna. So far, about 1500 species of butterflies have been recorded from India, of which about 314 species are found in Kerala, which include a high proportion of rare and endemic species. All of these butterflies are found in the Western Ghats region as well.

Butterflies being highly diversified in their habits require specific ecological conditions for their survival. Natural forests, grass lands, canopies of trees as well as wet areas along the banks of rivers and streams are the typical butterfly habitats. However, due to various reasons, particularly due to human intervention, the habitats of many butterflies have been altered. As a result, many species of butterflies that were once very common in our homesteads and countrysides have vanished. Species loss has tremendous implications on biodiversity. It has been stated that extinction of a single species would eventually lead to extinction of about a dozen or more species that are linked with it. A brief account of the main causes for the decline of butterfly poputations is given below.

Habitat loss:

Deforestation, habitat destruction for urbanisation, industrialization and agriculture, causes changes in temperature, humidity and rainfall. Prevalence of unfavourable weather conditions often affect habitat suitability leading to local extinction of butterflies (Van der Made, 1987; Pollard, 1979; Dempster and Hall, 1980; Elhrich *et al.*, 1980; Thomas, 1980). Pollution of natural environments is also harmful to butterflies.

Commercial collection:

Perhaps, the most important threat is collection of butterflies for trade. The effect of commercial collection on butterfly populations is controversial due to lack of data. However, its impact seems to be largely dependent on the biology of the species. Although most authors suggest that collection, can only affect already weakened populations (Spooner, 1963; Muggleton, 1973; Gardiner, 1974; Pyle, 1976) some workers (Sheldon, 1925; Mc Leod, 1979) are of the opinion that commercial collection can cause extinction.

Incidence of natural enemies:

Various predatory organisms such as birds, lizards, spiders and mantids; insect parasitoids and disease causing microorganisms may cause heavy casualty of the immature and adult stages of butterflies leading to large-scale mortality.

1.1. The concept of Butterfly Farming

The management and conservation of flora and fauna by habitat protection is well accepted and the concept of captive breeding and farming of butterflies is a positive step in this direction. Although butterflies have high fecundity, this potential is hardly realized under natural conditions. Because of the natural mortality factors due to unfavourable climatic conditions (drought, wind, temperature, etc.) and incidence of parasites and predators, the survival rate of butterflies in the wild is estimated to be only about 2%. By shielding the butterflies from such adverse conditions, a successful butterfly farmer will be able to enhance the survival rate from 2% to as high as 90%.

1.1. 1. History of development of Butterfly Farming Industry

The rearing of butterflies and moths is not a new commercial activity. The Chinese silk industry,

based on rearing the silk worm has been in existence for thousands of years. During the Victorian era (1860-1910), collection of butterflies became a serious vocation for many people in the West. At that time, members of the English aristocracy, endowed with wealth and leisure derived from the United Kingdom's flourishing global empire, collected, identified and catalogued Lepidoptera from all over the world. To cite an example, Lord Rothschild employed over 400 explorers for collecting butterflies from all over the world. Lord Rothschild's collection of butterflies, accumulated over a lifetime, constitutes the single largest personal collection of butterflies so far made.

Apart from collection of butterflies, attempts were also made to rear them using stocks procured from different parts of the world particularly from Southeast Asia. Most of these activities originated in the island of Guernsey in the English Channel in 1877. Agriculture and tourism were the important activities in this island. Both these industries particularly the tomato industry and tourism have faced serious setbacks. It was at this time that the idea of converting the vacant glasshouses into green houses of tropical plants was struck and to make them livelier, butterflies imported from Asia were introduced. The resulting enclosure, complete with waterfall and meandering brook was publicised as a butterfly exhibition and opened to the public. The first Insect House or insectarium was opened in 1881 at the London Zoo where preserved specimcns wcre kept as exhibits. Over the next 100 years, other Zoos also followed suit adding insects and other invertebrates as exhibits. The first commercial display of live butterflies was opened in Sherbourne, Dorset in England in 1960. In the early 1970s, the Guernsey Butterfly Farm on the Isle of Guernsey was established as the first true butterfly house. By 1986, there were over 40 butterfly houses on the British mainland (Hughes and Bennett, 1991). To the surprise, the project was an enormous success and marked the beginning of a new industry. Soon, there were several such units such as the Entomological Livestock Group, which liaised with each other through formation of nature clubs, for transaction of material that were bred out. By 1988, butterfly houses spread across the Atlantic. The 'Day Butterfly Center' in Georgia and the 'Butterfly World' in Florida and California were some of the butterfly houses that were opened in North America. During 1990s there has been resurgence in the popularity of butterfly houses with a number of permanent as well as temporary exhibitions being built. It was through these informal marketing channels that today's thriving

butterfly exhibit industry has developed (Toone, 1990).

I.1.2. Facilities required for Butterfly Farming

Compared to vertebrates, butterflies being relatively small in size requirc little space, reproduce rapidly and frequently produce large number of eggs. Most commercial butterfly houses in temperate countries are walk-through heated glass houses that are expensive to construct and maintain. Such 'free flight' butterfly houses are very common in Europe, North America, Japan, Australia, Singapore, Malaysia, Hong Kong and Kenya. However, such technologically sophisticated structures and capital requirements are not necessary in tropical conditions.

The technological simplicity of butterfly farming, therefore, minimizes the strain on underdeveloped or developing countries to establish a butterfly-breeding programme. This fact furthermore eliminates the dependence of the butterfly farmer on the availability of scarce imported materials and the technical expertise to maintain sophisticated equipment. Breeding techniques are also relatively simple which can be readily conveyed to the farmer with minimum explanation and demonstration.

I. 1.3. Conditions required for a butterfly breeding facility

Environmental conditions

For most Lepidoptera, the environmental requirements of adults and larvae are not similar. Tropical butterflies require day temperature of 25°C and 85-95 per cent relative humidity. Some tropical species require almost 100 per cent humidity before they will mate. Night temperature can drop to around 15°C. A slight and intermittent air current seems to stimulate flight in many butterflies and thus increases the frequency of feeding, mate locating and courtship behaviour. Butterflies should have access to moist sand and spraying with a mist of water is beneficial.

Nutrition

When planning a live butterfly exhibit, it is necessary to ensure the continued supply of nectar plants for the adults and food plants for the larvae. The nectar and larval food plants should be established while keeping in mind the landscaping aspects of the garden. The caterpillars being highly voracious may finish off the host plants in a short period. Therefore, provision should be made sufficient stocks of host plants in a green house or nursery. Propagation of plants should be undertaken at the appropriate season either as stem cuttings or from seeds. Seedlings thus obtained may be bagged in plastic covers and maintained as replacement stock. Since all the stages of butterflies are extremely susceptible to insecticides, caution should be taken in applying pesticides for controlling pests that might affect these plants. As far as possible pesticide application must be carried out only when it is absolutely essential and only appropriate biopesticides must be used. Application of biopesticides like neem cake regularly as a spray on foliage helps to check whiteflies, aphids and fungal infestations. Plants treated with pesticides should be used for butterfly breeding only after the withholding period.

Oviposition and care of eggs

Butterflies require ambient temperatures of about 25°C and many also need to bask under radiant heat sources in order to bring their body temperatures up to 32-35°C in preparation for oviposition. Appropriate larval host plants should be provided and as with mating, a little light may be necessary.

The eggs should be surface sterilized by immersion in solutions of sodium hypochlorite (0.1-0.2 per cent for five to ten minutes) or formaldeyde (10 per cent formal in for ten to 30 minutes) or both to kill any latent microbial pathogen. Depending on quantity, the eggs should be stored either in short plastic tubes, loosely plugged with cotton wool, or in small plastic boxes with perforated lids. Saturated solution of reagent grade Sodium chloride may be used to maintain a relative humidity of 75-76 per cent over the temperature range 0-25 ^{o}C.

Larval food plants

The management of important larval food plants should be closely monitored since the plants get quickly consumed. The breeding cage or garden should be planted with sufficient number of the host plants. In addition to this, adequate number of cuttings or seedlings should be kept ready so that sufficient quantity of host plants is always available. When more eggs are needed, the potted plants kept in pots in the green house may be brought into the flight area. Heavy watering of plants is necessary as most butterflies require high humidity levels and this leads to deterioration of soil structure. Organic manures may be applied periodically to keep the soil fertile. The plants may be transferred to the breeding area when enough eggs have been laid. Here, the caterpillars that emerge may be allowed to feed on the plant.

Development of artificial diets for larvae has revolutionized the captive breeding of Lepidoptera, although adequate supplies of dried leaves are very essential for preparation of diets. Diets based on a variety of ingredients have been proposed and Singh (1977) has produced a useful compendium on the artificial diets for various insects. The best diet developed seems to be the one prepared by David and Gardiner (1965) for the cabbage white *Pieris brassicae* using casein, wheat germ and dried cabbage leaf (as a phagostimulant) as the main ingredients. Morton (1981) obtained better results using germ yeast and 1.5 per cent (w/w) dried host plant. Since the water content of the diet is often a critical factor affecting palatability and larval growth rates, control of relative humidity is a particularly important aspect for rearing larvae on artificial diets.

Larval rearing

The methods for rearing larvae on growing host plants or on cut leaf material have changed very little from the earliest published accounts. Therefore, maintaining supplies of host plants is an important limiting factor affecting captive breeding programmes. The management of larval food plants plays a crucial role in the success of captive breeding programmes. Larval plants have to

be maintained both in the flight area (for enabling oviposition) as well as in the breeding area (to tend the larvae). Among the various factors involved, the growth and regeneration rate of the food plant, larval feeding efficiency, the part of the host plant used and total number of ovipositing butterflies are critical.

Pupation and eclosion

Butterfly larvae reared on artificial diet may be left to pupate on the walls or on the lid of the container. Pupae are usually found hanging or girdled to a substratum with the help of fine filaments. The pupae should be removed to an emergence cage once they have hardened. Pupae should be suitably mounted on strips of cork and kept reasonably moist. If required, they may be surface sterilized using 2-5 per cent sodium hypochlorite solution.

Nectar plants

The important factors to be considered when choosing the nectar plants are the feeding preferences of the butterfly species and the length and timing of flowering. Species such as *Clerodendum capitatum, Cuphea, Marigold, Lantana camara* and *Ixora* spp. which flower almost continually are the commonly used plants. Since the flowers of these plants have nectaries close to the surface, nectar is very easily accessible to most butterflies. Lycaenids and pierids with short proboscis prefer smaller flowers (eg. Compositae) while for the larger papilionid butterflies, flowers having a long pistil such as *Hibiscus, Ixora* and *Clerodendrum capitatum* are ideal.

Feeding of the adults

Adequate number of nectar plants in bloom should be maintained in the butterfly release area. When there is scarcity of flowers, artificial feeding may be attempted. Usually, sugar/honey solutions (10 per cent) are presented as soaked pads of cotton wool or in a tube fitted with a colored corolla. Butterflies often have strong species specific colour preferences. Since such colour preferences can change with age, it is important to provide a wide range. When given a choice of abundant floral

nectar and abundant artificial nectar, butterflies show a preference for the natural substance (Calvert, 1990). Moreover, for display purposes it would be more appealing to observe the butterflies exhibiting their natural feeding behaviour.

Some butterflies show preferences for other substances like fruits, berries, sap, dung and carrion. Rotting fruits to which about 10 per cent (w/w) honey has been mixed to assist fermentation are ideal for species attracted to fruits. The use of mud or urine for accumulating sodium is also important in certain species. All possible food sources must be provided as appropriate.

Conditions for mating

Though Lepidoptera are fairly easy to rear, they are difficult and expensive to maintain as viable breeding colonies. The most common cause of failure of Lepidoptera captive breeding programmes is the inability to secure pairings and fertile eggs. Most butterflies require a suitable environment for the display of elaborate courtship behaviour. Suitable dimensions for a flight arena relate to the wingspan of the species (x) as follows: length 20-25 x; height 10-15 x; depth 10-15x. However, very large cages are to be avoided because some species tend to disperse to the roof and sides and ignore potential mates (Morton, 1991 a). It has been observed that the presence of the larval host plant within the rearing cages will stimulate pairing in many butterfly species. If the emergence of adults is extended over too long a period, the optimum periods may not synchronize and it may then be difficult to secure pairings. The best way to avoid this problem is to rear larger batches so as to encourage synchronized emergence.

Conserving genetic variation in captive populations

All species need a broad genetic base if they are to avoid extinction and continue evolving. Evidence is accumulating that extinction may be a regular feature of the dynamics of butterfly populations (Shapiro, 1979; Ehrlich, 1984). Such extinctions may be due to ecological rather than genetic reasons (Berry, 1972).

Butterfly populations vary in space and through time and this fact holds important implications for conservationists. Fluctuations in populations have been reported in some butterflies (Gilbert and Singer, 1975; Ehrlich, 1984). The fact that butterfly populations are not interchangeable, ecologically or genetically, has led Ehrlich (1984) to advocate a conservation strategy which focuses attention on preserving genetic diversity within species through comprehensive habitat protection. Thus, when we try to preserve a species through captive breeding, we may simply produce a generalized gene pool with butterflies that lack close affinity to any individuals remaining in the wild and not adapted to any natural environment. The aim of the insect conservationist must therefore be to conserve the future evolutionary potential of a species, rather than to attempt to preserve any form of *status quo.*

The transfer of a population of organisms from its native habitat into an artificial rearing environment may be viewed as an act of domestication. From a genetic standpoint, such a transfer is in principle the same as that of any group of organisms colonizing a new and isolated habitat. The long-term persistence of even highly colonial butterfly species depends on their ability to colonize new habitats. Natural selection may be thought to have a winnowing effect, which acts by removing unsuitable genotypes and occasionally some suitable genotypes from the population.

Changes due to inbreeding

Captive populations will be exposed to a greater degree of inbreeding depression than natural populations. Inbreeding depression manifests itself in deterioration in vigor and health, as a consequence of a rapid loss of heterozygosity and the fixation of homozygous disadvantageous alleles through inbreeding. Many natural colonies of butterflies are isolated, small and have persisted in this manner for many generations. Hence, the amount of inbreeding in captive colonies, whose populations may be many times larger than their natural counterparts, is unlikely to be a problem (Morton, 1991 b).

If the founding stock is to survive and reproduce under captive breeding conditions, then it must carry existing adaptations permitting it to exploit its new environment. The existing adaptations must enable it to survive the transition from natural to captive

conditions. Genes that confer fitness in the field may not confer fitness in captivity and the new environment will select for new balanced gene system. The resulting domesticated populations may or may not be adapted to the natural environment.

I.1.4. Aspects to be considered while establishing a Butterfly Farm

Preliminary laboratory and field trials for setting up butterfly farms have been carried out at KFRI (Mathew, 2001). Butterfly farming, which is essentially a tourism-based venture, is yet to be tested as a commercial venture in India. The tourism industry is becoming very competitive and economic survival will depend on being sensitive to market conditions and dynamically adapting the service to the opportunities and visitor aspirations. The butterfly theme park is yet to be marketed as a concept and a destination. There fore, the financial prospects of the butterfly farming enterprises will depend on the ability to attract visitors. This will require intense and focused selling initiative and promotion. Even then, it will be relatively a smaller attraction compared to the multi-activity Amusement Parks that are currently attracting large number of visitors. Hence, the whole programme should have various components involving preparation of curios, souvenirs, photographs, paintings as well as educational and training packages addressed to the various sections of the society. To be successful, proper design and planning are required at every stage of establishment of a butterfly farm, which are discussed below.

Site suitability

Site suitability in terms of ecological and economical criteria is important in order to make butterfly-farming ventures sustainable. Unlike other themes, butterfly farms require appropriate habitats and environmental conditions conducive to the sustenance of butterflies in the project area. Habitats that are adjacent to natural forests are more suitable since such locations may favour colonization of diverse groups of butterflies. At the same time, income generation depends on visitors or stakeholders who make use of the farm. Being a novel venture, marketing a butterfly theme park / butterfly farm as a single point destination has serious limitations and the budget required for such a promotion would be exhorbitant. In order to make butterfly farms economically viable, it would be feasible to select an existing tourist location where already large

numbers of tourists converge. A one-time visit may not be enough to sustain the park in the long run and the financial prospects depend on getting repeated visits. For this, the park should have the plans to grow and diversify with attractive exhibits, interactive programmes and also as a picnic spot with toilets and recreational areas. It should also be very market sensitive to adapt to the aspiration and needs of the visitors. The changing visitor profile, the seasons, even the differences between a working day, a weekend or a holiday needs to be carefully considered for their potential for a varied menu of activities or differentiation in the entry fee which will be the basic source of revenue.

Landscaping and infrastructure development

A butterfly farm should be managed in a way that allows it to function symbiotically with the indigenous butterfly populations. An ideal habitat should be created by planting appropriate larval and adult food plants in the vicinity of the farm. With the establishment of these plants, the premises of the farm will become a butterfly sanctuary. Female butterflies, caught from the wild or from captive bred stock, are released to fly freely within the butterfly house which is a large field cage in which appropriate host plants have been introduced. Measurements of a typical butterfly house are 25 x 25x 3 m, though there are no optimal dimensions suggested. At KFRI, a field cage of 5 x 5 x 3m with all sides made of fine steel mesh was used (Mathew, 2001).

Financial aspects

The Butterfly Farm, to be a self-supporting commercial venture, needs to have financial independence. To run a farm that is financially self-supporting, it would be necessary to give the farm management much freedom and flexibility. They should be able to use the collection from the farm for farm maintenance and promotion. It should be in a separate account and there should be an appropriate reserve fund to use in times of emergency.

Aptitude for running commercial activities

Any commercial venture is fraught with risks particularly one which is yet to be marketed in this country and one managed by an organisation that has no experience in managing commercial activities. The range of risk is quite broad from ecological, commercial, policy changes and restraints to organisational incompetence. Risk of failure by its very nature is unpredictable but different components of it can be assessed for its likelihood in a given situation and within a definite time frame.

Operational / logistic aspects

In order to evaluate the prospects of making the Park financially viable, various operational / logistic aspects such as habitat suitability, financial viability, operational convenience, land availability, road access, fencing, watch and ward, scope for further development, water availability, fencing and electricity are also to be considered. Of all the above aspects, habitat / site suitability, financial viability and operational convenience are the most important.

I.1.5. Daily activities in a butterfly farm

The daily operation of a butterfly farm has many components. Principally, the entomological facet of breeding the butterflies, the horticultural duties of propagating the appropriate food plants and flowers, and inevitably the accounting and other paperwork are the important tasks.

Breeding of butterflies can be done using eggs collected from various plants in the vicinity or from butterflies reared in the laboratory. Typically, a fresh female can lay up to a hundred eggs. Some species will lay their eggs singly over many days. Others lay gregariously in a few sittings. Searching for the tiny butterfly eggs is not necessarily very tedious since the female butterflies will lay their eggs only on their respective host plant. The eggs may be laid on the underside of leaves or on the tendrils of the fresh new growth. With some experience, a person will be able to quickly locate and collect the eggs. The eggs must be removed daily from the flight areas and placed in a secure location where they are safe from various predatory organisms such as ants, spiders, wasps,

parasitic wasps and lizards. Parasite and predator proof plastic boxes can be used for keeping the eggs.

The eggs collected must be examined daily and when hatched, the first instar larvae should be transferred to potted food plants kept inside cages. During the first three instars lasting for about two weeks, the caterpillars feed only very little. After this stage, they become more voracious and during this period, it is necessary to provide adequate quantity of food plants. Because of the increased feeding rate, it may not be practical to feed them on potted plants; rather, they can be fed on branch cuttings with the stems of the cuttings placed in a bottle containing water in order to preserve the freshness of the foliage.

Maintenance of sanitary conditions is very essential. Every day, the cages must be cleaned and the remains of stems and foliage as well as the excrement should be removed and fresh supply of branch cuttings made. Otherwise, the larvae are likely to suffer from various diseases. On completion of the fifth instar, the larva attains full maturity and they pupate by attaching themselves to the ceiling of the cages or on the food plants. Care must be taken to collect pupae daily from the cages. Since the pupal stage is of short duration, the date of pupation must be accurately noted.

I. I. 6. Role of Butterfly Farms

In conservation / environmental education

The most effective conservation measures in any part of the world will be those, which can show a financial return. Butterfly Houses serve two important roles, first as a tourist cum educational institution for promoting public awareness on nature conservation and secondly as a centre for *ex situ* conservation. Captive breeding is possible for many species and butterfly houses can help conservation through scientific research and education of the public. As long as the wild caught material is harvested in a sustainable manner, there will be no threat to the species exhibited.

Although a thorough analysis of the potential for butterfly ranches around the world has never been made, there are many opportunities in tropical Africa, S. America and Asia.

As a business

Butterfly farming is an alternative source to provide material for trade, for scientific study or for building up representative collections. Butterfly trade is already a well-established business in several countries like the UK, USA and Papua New Guinea. In butterfly trade, pupae below three days old are preferred for shipping. The world's leading producers of butterfly pupae are Malaysia, Philippines, Thailand, Taiwan, Kenya, Madagascar, the USA, El Salvador and Costa Rica. Britain has 50 to 60 butterfly houses attracting five million visitors annually and gate collections exceeded 5 million pounds (Collins, 1987a). Similarly, the Niagara Parks Commission's Butterfly Garden in Ontario, opened in December 1996, is a $15 million dollar facility attracting about 20,000 visitors during weekends. In North America, more than a dozen major exhibits are already operating and many units are under construction. In Papua New Guinea, Malaysia, Madagascar and the Philippines, there was significant increase in foreign currency through butterfly trade. In the former, over 700 species of butterflies were traded and it has been demonstrated that farming bird-wing butterflies can produce more income per given area than cultivating coffee (Bloch, 1988).

Another growing market for live butterflies is for butterfly releases in connection with special occasions such as weddings, launching of new programmes or for charity. Recently, in Costa Rica, members of the legislature took part in a butterfly release as part of a fund raising event for street children. It should, however, be mentioned that some precaution should be taken for such release of butterflies and only local butterflies should be released since the effects of releasing exotic /genetically modified butterflies into other habitats and parts of the world are not known.

I. 2. Scope for the development of Butterfly Farming Enterprises in India

India with its rich butterfly fauna holds great potential for butterfly fanning enterprises. Development of butterfly farming enterprises is a suitable option for rural upliftment programmes in the villages. Khoshoo (1984) has stated that biodiversity 'hot-spots' like the North Eastern Himalayas and Western Ghats contain a diverse butterfly fauna and may be considered as ideal areas for butterfly farming enterprises.

The major impediments in the establishment of butterfly farming enterprises in India are the biodiversity conservation laws existing in the country. There is ban in the trade of butterflies particularly of those included in the schedules of (Government of India) (GOI, 1972). Preparation of curios and souvenirs using dead insects is also banned. Similarly, permission of the Central Zoo Authority is required for maintaining butterflies under captivity. The incorrect interpretation of conservation laws has often adversely affected even genuine explorations involving sustainable utilization of wild biodiversity. The ban on captive breeding of butterflies is an example. Hence, there is a need to examine these laws and make necessary amendments so as to facilitate conservation and sustainable utilization of our rich biodiversity.

Review of Biodiversity Conservation Rules

Conservation and sustainable utilization of biodiversity are very essential for the survival of mankind in this universe. It is well recognized that the livelihood of man is dependant on materials derived from nature. Although various attempts are being made to develop value added products from selected natural resources, not much breakthrough has been made in these lines for a major portion of biotic resources partly due to lack of sufficient understanding on the role played by various organisms in the functioning of natural ecosystems and the factors affecting their survival. In this context, it may be pointed out that in India, many organisms- both vertebrates and invertebrates- are being bred for scientific or commercial purposes for hundreds of years without affecting their wild populations. Among insects, fruit flies, parasitic wasps, lac insects, honeybees and silk worms are well known examples. It is now a well-established fact that populations are endangered mainly due to large-scale habitat destruction and not by harvest of insects.

With regard to butterflies, the local population can be enhanced by introduction of appropriate host plants and through habitat improvement. This provides easy access to butterflies while having little or no negative impact on the wild population in the area. This non-destructive utilization of a natural resource provides motivation for conservation by making the standing forest an economic asset (Vietmeyer, 1988). The biodiversity conservation rules need to be reexamined and necessary amendments made not only to promote conservation but also to enable its sustainable utilization.

Establishment of an agency for promoting butterfly farming initiatives

Probably the best strategy to promote butterfly farming activities is to set up a network of butterfly farmers. Papua New Guinea's is the best model that could be adopted. The ranching of butterflies has proved successful in Papua New Guinea (Anonymous 1983; Hutton, 1985). In that country, an Insect Farming and Trading Agency (IFTA) was established in 1978 in Bulolo with the objective of encouraging ranching of native butterfly species. The IFTA is also continuing to improve breeding techniques and to provide new data on the life history and hosts of several butterflies, so that subsequently, any species in the country can be farmed for their benefit. A similar agency can be set up in India as well to promote butterfly-farming enterprises.

Current initiatives on developing butterfly farming enterprises in Kerala

A project for establishing a Butterfly Farm by KFRI was approved by the Western Ghats Cell of the Planning and Economic Affairs Department vide GO MS No. 42/2000 dated 14.9.2000. The main objective of this project was to demonstrate the financial viability of a Butterfly Farm run on commercial lines (Fig.1). Essentially the project was conceived as a tourism based venture to be run on self generated funds. Various aspects that require special consideration while establishing butterfly farms such as site suitability (in ecological and economic terms), financial prospects as well as operational and logistic aspects were considered.

II. Materials and methods

11.1. Site selection for setting up the Butterfly House

Altogether, 11 sites viz., Thiruvananthapuram Zoo, Thenmala, Thekkady, Munnar, Mangalavnam (in Ernakulam), Nedumbassery (near the Cochin Airport), Adirappally, KFRI campus at Peechi, KFRI campus at Nilambur, Kuthiran and Malampuzha were considered for setting up the butterfly farm. Since economic and ecological feasibility of the project site is very essential for the success of butterfly farming enterprises, a detailed analysis of these parameters was done with respect to the sites that were considered to be ideal for setting up the farm. Evaluation of each location was carried out by ranking each location after discussing the options using a SWOT (Strength-Weakness-Opportunities-Threats) analysis. Ranking was done on a five-point scale with score 1 for the best / ideal / economic and score 5 for the worst. Score 3 was considered as a threshold limit particularly for the first criterion of habitat suitability. Locations ranked under score 4 and 5 were considered to be unfit and discarded. The worst site under each criterion was eliminated progressively. Details pertaining to the ranking of various criteria are given below.

Economic returns

Within the financial criteria, the parameters considered were (1) the proximity to a tourist destination and potential for tourist arrivals, (2) cost of infrastructure developments such as landscaping, fencing, access routes, etc. and (3) viability of the park as a commercial venture. For this, a rough cost benefit analysis was done.

Habitat suitability

Under habitat suitability, the potential of the proposed location in sustaining natural populations of butter1lies was evaluated. Areas near natural forests or locations having relict vegetations were considered to be ideal for setting up butterfly habitats.

11.2. Legal clearance to establish the facility

Technical clearance from the Kerala Forest Department and the Central Zoo Authority of India was necessary to set up the farm in forest areas and to initiate captive breeding of butterflies. As soon as the project sanction was obtained, action was initiated to get necessary clearance from these agencies for implementing the project.

II.2.1. Preparation of technical design of the Butterfly Farm

A Butterfly Farm essentially consists of 1) a laboratory meant for butterfly breeding, 2) a Butterfly House where butterflies are kept for both exhibitory, mating and breeding and 3) a sales-cum-extension counter to generate revenue (Fig.1). The surroundings of the butterfly farm have to be developed into a garden where visitors can observe butterflies in their natural settings. This area will also serve as a source for eggs and caterpillars of butterflies for maintaining the laboratory culture. Considering all these aspects, the final design of the farm was prepared.

Ill. Results

Ill. 1. Site selection

The summary of the ranking exercise based on the three important criteria viz., habitat suitability, financial prospects and operational convenience is given in Table I. The first criterion on habitat suitability, serve to eliminate the sites that have problems on ecological grounds.

Of the various locations considered, Mangalavanam and Nedumbassery were rejected. The former being a bird sanctuary, the butterfly garden will have problem from predatory birds. Nedumbassery is a lowland away from the forests and the proposed site (belonging to the Forest Department) has a KSEB sub station right in the middle dividing the patch into two. This area, which was an agricultural land, was poor in natural populations of butterflies. Munnar, a well-established tourist destination in the Western Ghats, was dropped due to its high elevation and frequent mist formation. Also, the availability of land was doubtful as the Tata Tea occupies most of the prime land. Malampuzha, another tourist destination with large tourist number, was also not favourably considered due to the dry habitat and warm winds.

After eliminating the above locations, the short list has now been reduced to Thiruvananthapuram Zoo, Thenmala, Adirapally, Kuthiran, KFRI Peechi, Thekkady, and KFRl Sub Centre at Nilambur. Since all these locations were found to have ideal habitats, the second criterion viz., the economic aspects were considered. It was estimated that approximately, Rs. 6,00,000 will be required annually to maintain the facility, which works out to Rs. 50,000 monthly or Rs, 2,000 daily. Since the visitors would be less during the monsoon and other off-seasons, the revenue during the peak season should be sufficiently high to offset the decline. In this instance, as it has to be a self financing venture at least in working expenses, the entry fee has to match the running cost. A differential pricing with different rates for working days, weekdays and vacations along with different entry fee for adults, children and group of school students and a higher fee foreigners was considered to ensure the financial viability.

Assuming that the Farm management is empowered to fix and charge the entry fees according to the market conditions, an entry fee of Rs. 25 for adults and Rs. 10 for children is proposed. In order to attract student groups, concession rates at Rs. 10 for college students, Rs. 5 for school students and Rs. 2 for primary school students are also proposed. The rates for foreigners are fixed at Rs. 50 for adults and Rs. 10 for children. Off-season pricing is also proposed to be low enough to attract at least a minimum number of visitors every day.

With regard to the economic returns, Thiruvananthapuram Zoo was considered to be an excellent location as it is easily accessible; it attracts a large number of tourists interested in wildlife and has many other attractive features. The visitor arrivals to the Thiruvananthapuram Zoo during 2003 was over 1,00,000, and the gate collection alone was over Rs. 50,00,000. The large resident urban population and a continuous row of visitors from all walks of life, gives it a preeminent position. The proximity to the international airport and Kovalam Beach Resort ensures a sizable number of foreigners too.

Among the other short-listed sites, the maximum current tourists are in Thekkady with a good mix of students as well as local, national and international tourists. It is the ideal location where, nature loving tourists aggregate. The boating facility in the Periyar Lake is the prime attraction for the tourists to Periyar. Many tourists, particularly the foreigners, spend 2 to 5 days in Thekkady. They will have the time and inclination to visit a butterfly park, if available. There is also a large floating population of day visitors who wait for many hours in the queue for a boat ride. They would be more than willing to occupy themselves in the butterfly farm.

Thenmala is being promoted as a tourist destination but it is yet to attract sufficient numbers of visitors of different categories. A butterfly farm will be one among the many attractions planned in this complex. A differential pricing is offered for the various themes in the Farm and once attractive items are available, it will be possible to attract the serious visitors who could spend maximum time within the Farm. Thenmala has potential to develop into a major tourism

destination and hence the butterfly farm will have better prospects.

Adirappally, another area considered, is fast developing as a tourist destination with the waterfall and water theme parks. Since there are a number of themes offered, the entry fee to the water theme parks is very high. A visitor would normally choose to stay on till it is time for his return, by which time the butterfly farm would be closed. Butterfly activities stop before evening and there is little

Table I. Ranking of sites based on different criteria

Site	Habitat suitability	Financial prospects	Operational convenience	Score	Ranking
Thiruvananth-apuram Zoo	2	1	2	5	2
Thenmala	1	2.25	2	5.25	3
Thekkady	2	1	3	6	6
Munnar	2	2.5	3	7.5	8
Mangalavnam	5	2	2	9	10
Nedumbassery	5	2.25	2	9.25	11
Adirappilly	1	2.5	2	9.25	4

KFRI campus, Peechi	1	3.75	1	5.75	5
Kuthiran	1	2.75	1	4.75	1
Malampuzha	3	2	2	7	7
KFRI sub centre campus, Nilambur	2	4	2	8	9

chance of enticing the visitors of the water theme parks to visit the butterfly farm after they finish with the Water Park. If the visitors have to take full advantage of the butterfly farm, they will have to come to the butterfly farm before they enter the Water Park. This would require great promotion and advertising. Adirappally has an added risk of the power project that may come through which might affect the waterfall. In case the waterfall is affected or becomes erratic, there may be a decline in the number of tourists visiting the area. This will leave the butterfly farm high and dry.

Kuthiran on the ridge between Trichur and Palghat is another site, which is right on the National Highway. Presently it is not a tourist destination or a place where the travellers stop. Kuthiran has certain advantages such as lush forests, which can be developed as a cool stop over for travelers coming in from the drier Palghat and Tamil Nadu. If the entire frontage is changed with attractive hoardings and an inviting open gate, people can be induced to enter and stroll through the nature trail and visit the proposed butterfly farm. As Kuthiran is away from any other tourist facilities or amenities, the butterfly farm at Kuthiran should provide the necessary facilities and amenities for the visitors. If sufficient land is available to develop it as a complex with more nature based attraction and amusements, then Kuthiran can be developed as a good butterfly park. However, financial viability cannot be quickly achieved, as it would be the only tourist oriented venture in the locality. The proximity to the national highway is a positive asset and it is on the way to

Malampuzha, Coimbatore and Ooty.

The KFRI campus, Peechi, which already has a small butterfly park, has several advantages, the most important being convenience of establishing, supervision and decision-making. The work can start right away as the land is already with us. The habitat, facilities and proximity make it ideal. But on economic grounds, it is unlikely to be viable as the only other tourist location, the Peechi Dam and garden are so poorly maintained at present that visitor numbers may be insufficient. The KFRI sub centre at Nilambur was also considered where land, infrastructure and trained entomologists are available. However, since Nilambur is not at present a tourist destination, the financial prospects are bleak.

With regard to the third criterion viz., operational convenience, Kuthiran and KFRI campus at Peechi are more convenient. But, the financial prospects are bleak compared to the other locations. Hence, these locations are not given much priority under this criterion.

III. 1. 1. Site allottment

The scores for various sites considered for setting up the butterfly farm are given in Table 1. Based on the ratings, Kuthiran was scored first followed by Thiruvanathapuram Zoo, Thenmala and Adirappilly. Mangalavanam and Nedumbassery were least suitable.

Mere identification a particular location does not give any guarantee that the farm could be established in that area since prior permission of the concerned authorities is required for establishing the farm. So, in the subsequent stage, discussions were made on the possibility of establishing the farm in the locations considered to be suitable. Several sites such as Kuthiran, Thiruvanathapuram Zoo, Thenmala and Thekkady were not available for establishment of the farm because of various administrative or technical reasons. Ultimately, Adirappilly, KFRI campus at Peechi and Nilambur were the only locations where land was available for setting up the butterfly farm could be established. Of these, Adirappilly was found to be more appropriate and hence actions were initiated to get necessary land allotted.

After preliminary discussions with the Kerala Forest Department, Thumburmoozhi, a location near Adirappilly waterfalls was selected for establishing the butterfly farm. This site located on the banks of the Chalakudy River was already a degraded forest patch having an abandoned building in it and this site was most appropriate both in terms of habitat and accessibility to tourists. A formal request to allot this land for this project was forwarded to the Principal Chief Conservator of Forests with the recommendation of the Conservator of Forests, Central Circle. Although assurances were given to allot this site, no formal clearance was received for nearly two years. Since the files remained pending with the Department, it was finally decided to abandon this area in favour of the KFRI Sub Centre campus at Nilambur. Here, 0.5 ha land was allotted for setting up the park.

III. 1. 2. Constraints in project implementation

Having selected the site, the Zoo Authority of India was approached through the Chief Wildlife Warden for permission to establish the Butterfly House and to maintain butterflies in captivity. There was no positive response from the Authority and the request remained unprocessed pending explanation on various details of the proposal for nearly two years. In the meanwhile, a butterfly house was already established in the Science City, Calcutta with Zoo Authority permission. In the same period, construction of a full-fledged Butterfly House was initiated in the Bennerghetta Biological Park, Karnataka, by the State Forest Department and the State Zoo Authority. Unfortunately, the Zoo Authority gave no clearance to this proposal. Hence, it was not possible to go ahead with the project activities and the sponsoring agency (Planning and Economic Affairs Department) declined to release further installments of the project grant. As a result, the butterfly house could not be established and the project had to be limited to the establishment of a butterfly garden.

Ill. 2. Details of the Butterfly Garden set up in Nilambur

As has already been stated, butterfly garden is an essential component of a butterfly farm. The major activities included landscaping of the area for recreating butterfly habitats and introducing appropriate host plants for sustaining various butterflies. Since environmental education of the public is one of the important targets of such programmes, care was also taken to make an exhibitory of the butterflies in the garden. Based on these considerations and of the topographical and ecological characteristics, the layout of the garden was prepared (Fig. 2).

The project area was fenced using pre-fabricated steel frames, over which various creepers such as *Aristolochia indica, Passiflora edulis, Ipomoea* sp., *Wattakaka volubilis, Tylophora indica* etc., which serve as host plants of various butterflies were introduced. Rows of *Clerodendrum capitatum, Cassia* spp., and *Lantana camara* which formed the main nectar sources as well as various larval plants such as *Michelia champaca, Zinnamom zeylanicum, Zanthoxylum rhetsa, Strobilanthus lawsonii, Aegle marmelos, Citrus aurantia* and *Hydnocarpus pentandra* were also planted along the borders to sustain a wide spectrum of butterflies. The project area having plain terrain was made undulating through landscaping in order to create more surface area for retaining high humidity within the garden, which is preferred by most butterflies. The ground vegetation and the leaves accumulated on the ground were left undisturbed in order to offer suitable habitats for satyrid butterflies.

Different butterfly habitats such as lawns, rock gardens, streams, bushes, lianas, creepers and hedges were set up on either side of a trek path of 1.2 m width traversing the garden. On either side of the trek path, various butterfly host plants such as *Ixora* spp., *Cassia* spp., *Allamanda cathartica, Hibiscus rosa-sinensis, Cuphea miniata, Zinnia haageana*, Marigold, *Clerodendrum capitatum, Lantana camara, Wattakaka volubilis, Thotea siliquosa, Tylophora indica, T. camosa, Asclepias* sp., *Calotropis gigantea, Carissa carandus, Ruta graveolens* and *Aegle marmelos, Albizia lebbeck, Cassia* spp., *Citrus* spp., *Murraya koenigii, Mussaenda luteola, M. laxa, Ixora spp., Kalanchoe blossfieldiana* and *K. pinnata* were introduced to sustain various butterflies within the garden. A list of important butterfly host plants is given in Appendix I.

Most butterflies require high atmospheric humidity and for this, cascades, streams and ponds were also set up. The cascade was set up on a small hillock of 4 m height. There were three ponds, which were interconnected by a network of streams. The edges of the ponds and the stream were packed with river stones. Plants such as Pandanus, reed, water lily, waterweeds etc., were planted along the sides of streams and ponds to give a natural setting. The surrounding areas were planted with host plants of danaid, Iycaenid and nymphalids butterflies such as *Cycas* palms, Cuphea, *Cassia tora, Jatropha podogirica, Kalanchoe blossfieldiana, K. pinnata, Heliotropium keralense* and *Crotalaria retusa*. The latter two species are known to promote aggregationof various danaine butterflies. In order to facilitate circulation of water, a 375 W (0.5 HP) motor operated by a photovoltaic system was set up. Cement benches were erected at various places for enabling the visitors to relax or make observations on the butterflies.

lII. 2. i. Butterfly population within the garden

Altogether 50 species of butterflies were recorded from the garden during the period of study as presented in Appendix 11. During the rainy season (June-October), various large butterflies such as *Troides minos, Papilio paris, Chilasa clytia, Papilio demoleus, P. polytes, Tros hector* and *T. aristolochiae* were present in the garden. In addition to these, large scale aggregation of the danaine butterflies *Parantica aglea, Tirumala limniace, Danaus chrysippus* and *Euploea core* was noticed on *Crotalaria retusa* plants. During the months January to April when the summer sets in, emigrants, grass yellow (Eurema spp.) and Red Pierrot (*Talicada nyseus*) were present in large numbers. Each Crotalaria plant hosted 30-40 butterflies belonging to different danaine species. The former two species were developing on saplings of Sesbania and *Cassia fistula* while the latter was breeding on *Kalanchoe blossfieldiana* and *K. pinnata.*

IV. Summary

During recent years, butterfly farming has grown into a flourishing industry in several countries. In many tropical countries, butterfly farming is absolutely dependent on the native vegetation and the butterfly farmer has an inherent mutual relationship with native habitats. In Papua New Guinea, local farmers encourage the wild insects to colonise and breed in their gardens or farms by establishing the appropriate food plants. A certain proportion of the pupae are allowed to remain in the field and the remaining is collected. When the imagines emerge, they are processed for commercial purposes. The project provides income for the villagers and at the same time helps to ensure the continued survival of butterflies. The same methods may be easily followed in our country.

The fear that butterfly trade may lead to depletion of the fauna is baseless. Butterfly farming is done with material made available through captive breeding in the same way as silk moth rearing. For thousands of years, the silk industry has been performing without depleting the silk moths. In fact, the genetic diversity of the silk moth has been enriched and several races of silk moths are available. Butterfly farming will benefit people in rural areas, as it will augment their income. Also, the local dependence of local population on native species will strengthen efforts for protection of nature and natural resources. To ensure that wild butterfly population is not exploited, appropriate authority may be set up for certification of the source of material.

Due to the following reasons, the Butterfly Farm as envisaged in the project could not be established:

Land at Thumburmoozhi which was promised to be allotted for the project was not made available by the Forest Department.

The Central Zoo Authority did not convey formal sanction to go ahead with the project activity.

The funding agency (Planning & Economic Affairs Department) declined to release further grants because of the above reasons.

Although the butterfly farm could not be established, the butterfly garden developed as part of this project in Nilambur is a great success attracting a lot of people from all walks of life.

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Appendix I. A list of larval food plants of butterflies (Balakrishnan and Jaffer Palot, 2004)			
No.	**Scientific name**	**Common name**	**Host plant**
	PAPILIONIDAE		
1.	*Troides minos*	Southern Birdwing	*Aristolochia indica, Aristolochia tagala, Thottea siliquosa*
2.	*Pachliopta pandiyana*	Malabar Rose	*Thottea siliquosa*
3.	*Pachliopta aristolochiae*	Common Rose	*Aristolochia indica, Aristolochia bracteolata*
4.	*Pachliopta hector*	Crimson Rose	*Aristolochia indica, Thottea siliquosa*
5.	*Graphium sarpedon*	Common Blue Bottle	*Polyalthia longifolia, Persea macrantha, Alseodaphne semicarpifolia, Cinnamomum camphora, C. malabathrum, C. macrocarpum, Litsea chinensis, Miliusa tomentosa*
6.	*Graphium doson*	Common Jay	*Polyalthia longifolia, Miliusa tomentosa, Cinnamomum macrocarpum, C.malabathrum, Michelia champaca, Annona lawii, Magnolia grandiflora*
7.	*Graphium agamemnon*	Tailed Jay	*Polyalthia longifolia, Uvaria narum, Michelia champaca, Artabotrys hexapetalus, Polyalthia cerasoides, Annona reticulata, Annona squamosa, Annona muricata, Cinnamomum* spp.
8.	*G. antiphates*	Five-bar Sword- tail	*Annona elegance, A. lawii, A. zeylanica, Miliusa* sp., *Uvaria* sp.
9.	*Graphium antiphates*	Five-bar Sword -tail	*Annona elegans, Annona lawii, Annona zeylanica, Miliusa* sp., *Uvaria* sp.
10.	*Papilio clytia*	Common Mime	*Cinnamomum zeylanicum, Cinnamomum camphora, Cinnamomum macrocarpum, Litsea chinensis, Persea macrantha, Alseodaphne semicarpifolia*
11.	*Papilio demoleus*	Lime Butterfly	*Aegle marmelos, Glycosmis arborea, Murraya koenigii, Ruta graveolens, Chloroxylon* sp., *Swietenia* sp. , *Citrus* spp.
12.	*Papilio polytes*	Common Mormon	*Atlantia racemosa, Aegle marmelos, Glycosmis arborea, Murraya koenigii, Zanthoxylum rhetsa, Citrus* spp., *Triphasia* spp.

13.	*Papilio polymnestor*	Blue Mormon	*Glycosmis arborea, Atlantia racemosa, Atlantia wightii, Paramigyna monophylla, Citrus* spp.
14.	*Papilio helenus*	Red Helen	*Zanthoxylum rhesta, Thoddalia asiatica, Evodia roxburghiana, Clausena heptaphylla, Citrus lemon, Phellodendron* sp.
15.	*Papilio liomedon*	Malabar Banded Swallowtail	*Evodia roxburghiana, Acronychia pedunculata*
16.	*Papilio dravidarum*	Malabar Raven	*Glycosmis arborea*
17.	*Papilio paris*	Paris Peacock	*Evodia roxburghiana, Thoddalia asiatica, Zanthoxylum ovalifolium, Citrus* spp.
18.	*P. buddha*	Buddha peacock	*Zanthoxylum rhetsa*
19.	*P. crino*	Common Banded Peacock	*Chloroxylon swietenia*
	PIERIDAE		
20.	*Catopsilia pomona*	Lemon Emigrant/Common Emigrant	*Bauhinia racemosa, Butea monosperma, Cassia fistula, Cassia tora, Cassia siamea, Cassia allata*
21.	*Catopsilia pyranthe*	Mottled Emigrant	*Cassia fistula, Cassia allata, Cassia tora, Cassia occidentalis, Cassia auriculata, Cassia siamea, Gnidia glauca, Sesbania grandiflora, Sesbania bispinosa*
22.	*Eurema brigitta*	Small Yellow	*Cassia kleinii, C. mimusoides*
23.	*Eurema laeta*	Spotless Grass Yellow	Leguminosus plants
24.	*Eurema blanda*	Three- spot Grass Yellow	*Albizia* spp., *Cassia fistula, Delonix regia, Mouluva spicata, Pithecelobium dulce, Cassia* sp.
25.	*Eurema hecabe*	Common Grass Yellow	*Cassia fistula, Cassia tora, Albizia spp., Moulluva spicata, Cassia alata, Cassia sophera, Cassia mimosoides*
26.	*Colias nilgiriensis*	Nilgiri Clouded Yellow	*Parochetus communis*

27.	*Delias eucharis*	Common Jezebel	*Dendrophthoe falcata, Helianthes elastica, Scurrula parasitica, Viscum* spp.
28.	*Leptosia nina*	Psyche	*Cleome rutidosperma, Cleome viscosa, Capparis spinosa, Capparis zeylanica, Crateva adansonii, Capparis rheedii*
29.	*Prioneris sita*	Painted sawtooth	*Capparis zeylanica, Capparis tenera*
30.	*Pieris canidia*	Indian Cabbage White	*Brassica oleracea* (Cabbage), *Rorippa dubia, Sisymbrium* sp.
31.	**Cepora nerissa**	Common Gull	*Capparis decidua, C. sepiaria, C. rheedii, C. zeylanica, Cadaba fruticosa, Maerua oblongifolia*
32.	*Cepora nadina*	Lesser Gull	*Capparis moonii, C. cleghornii, C. rheedii, C. roxburghii*
33.	*Anaphaeis aurota*	Caper white/Pioneer	*Cadaba fruticosa, Capparis spinosa, C. sepiaria, C. zeylanica, C. decidua, C. rheedii, C. pyrifolia, Maerua oblongifolia*
34.	*Anapheis aurota*	Caper White/ Pioneer	*Cadaba fruticosa, Capparis decidua, C. rheedii,* C. *sepiaria,* C. *zeylanica,*
35.	*Appias indra*	Plain Puffin	*Drypetes oblongifolia, Drypetes roxburghii*
36.	*A. libythea*	Striped Albatross	*Capparis cleghornii,* C. *sepiaria,* C. *zeylanica, Crateva adansonii*
37.	*Appias lyncida*	Chocolate Albatross	*Crateva adansonii, Capparis cleghornii*
38.	*Appias albina*	Common Albatross	*Drypetes oblongifolia, D. roxburghii, Drypetes venusta*
39.	A. wardii	Lesser Albatross	Capparis rheedii, Drvpetes venusta
40.	*Colotis amata*	Salmon Arab	*Salvadora persica,* S. *oleoides, Azima tetracantha*
41.	C. etrida	Small Orange Tip	Cadaba fruticosa, Maerua oblongifolia
42.	*C. eucharis*	Plain Orange Tip	*Cadaba fruticosa*
43.	C. *danae*	Crimson Tip	*Cadaba fruticosa, Capparis divaricata,* C. *sepiaria, Maerua oblongifolia*
44.	C. fausta	Salmon Arab	Capparis spinosa, Maerua oblongifolia

45.	*Ixias pyrene*	Yellow Orange Tip	*Capparis sepiaria, C. zeylanica*
46.	*Pareronia valeria*	Common Wanderer	*Capparis zeylanica, C. rheedii*
47.	P. ceylanica	Dark Wanderer	Capparis rheedii
48.	*Hebomoia glaucippe*	Great/Giant Orange Tip	*Capparis moonii, C. spinosa, C. sepiaria, C. zeylanica, Crateva adansonii*
	NYMPHALIDAE		
49.	*Discophora lepida*	Southern Duffer	Bamboos
50.	*Parantirrhoea marshalli*	Travancore Evening Brown	*Ochlandra scriptoria*
51.	*Melanitis leda*	Common Evening Brown	Grasses
52.	*M. zitenius*	Great Evening Brown	Bamboos
53.	*M. phedima*	Dark Evening Brown	*Apluda* spp., *Cyrtococcum* spp., *Eleusine* spp., *Oplismenus ompositus, Oryza sativa, Panicum* spp., *Sorghum* spp., *Zea* spp.,
54.	*Elymnias hypermenstra*	Common Palmfly	*Cocos nucifera, Areca catechu, Arenga wightii, Calamus rotang, Phoenix* sp., *Ornamental palms*
55.	*Lethe europa*	Bamboo Tree Brown	Bamboos
56.	**L.** drypetis	Tamil Tree Brown	Bamboosa arundinacea and other bamboos
57.	**L.** rohria	Common Tree Brown	*Apluda* sp., *Capillipedium* sp., *Microstegium* sp.
58.	*M. anaxias*	White Bar Bush Brown	*Oplismenus compositus*
59.	*Mycalesis perseus*	Common Bush Brown	Grasses
60.	*M. mineus*	Dark-brand Bushbrown	Grasses
61.	*M. subdita*	Tamil Bush Brown	Grasses

62.	*M. igilia*	SmaIl Long-brand Bush Brown	Grasses
63.	*M. visala*	Long-brand Bush Brown	Grasses
64.	*M. khasia*	Pale-Brand Bush Brown	Grasses
65.	*M. adolphei*	Red Eye Bush Brown	Grasses
66.	*Mycalesis patnia*	Glad Eye Bush Brown	Grasses
67.	*M. oculus*	Red Disc Bush Brown	Grasses
68.	*M. davisoni*	Lepecha Bush Brown	Grasses
69.	*Zipoetis saitis*	Tamil Cat's Eye	*Ochlandra* sp.
70.	*Orsotrioena medus*	Nigger	Grasses
71.	*Zipoetis saitis*	Tamil Cat's Eye	*Ochlandra* sp.
72.	*Ypthima asterope*	Common Three Ring	Grasses
73.	*Ypthima huebneri*	Common Four-ring	Grasses
74.	*Ypthima ceylonica*	White/Ceylon Four-ring	Grasses
75.	*Y. avanta*	Jewel Four-ring	Grasses
76.	*Ypthima baldus*	Common Five-ring	Grasses
77.	Y. chenui	Nilgiri Four-ring	Grasses
78.	*Y. philomela*	Baby Five-ring	Grasses
79.	*Y. yphthimoides*	Palni Four-ring	Grasses

80.	*Polyura athamas*	Common Nawab	*Adenanthera pavonina, Caesalpinia sappan, C. bonducella, C. nuga, Acacia catechu, A. pennata,*
81.	*P. schreiber*	Blue Nawab	*Moulluva spicata, Rorea santaloides, Nephelium lappaceum, cynometra cauliflora*
82.	*Charaxes bernardus*	Tawny Rajah	*Tamarindus indicus, Miliusa tomentosa, Aglaia elaegnoidea*
83.	*Charaxes solon*	Black Rajah	*Tamarindus indicus, Moullava spicata*
84.	*Acraea violae*	Tawny Coster	*Passiflora edulis, Adenia bondala, Hibiscus cannabinus, Passiflora foetida, Passiflora subpeltata*
85.	*Cethosia nietneri*	Tamil Lacewing	*Adenia bondala, Passiflora edulis, Passiflora subpeltata*
86.	*Vindula erota*	Cruiser	*Adenia bondala, Passiflora edulis, Passiflora subpeltata*
87.	*Cupha erymanthis*	Southern Rustic	*Flacourtia montana* *Flacourtia indica, Flacourtia* sp.
88.	*Phalanta phalantha*	Common Leopard	*Flacourtia indica,Flacourtia montana, Smilax* sp., *Salix* sp., *Xylosma longifolium*
89.	*Phalanta alcippe*	Small Leopard	*Rinorea bengalensis*
90.	*Cirrochroa thais*	Tamil Yeoman	*Hydnocarpus pentandra, Hydnocarpus alpina*
91.	*Argyreus hyperbius*	Indian Fritillary	*Viola* sp.
92.	*Rohana parisatis*	Black Prince	*Celtis tetrandra,* C. *lycodoxylon*
93.	*Euripus consimilis*	Painted Courtesan	*Trema orientalis*
94.	*Neptis jumbah*	Chestnut-streaked Sailor	*Moullava spicata, Xylia xylocarpa, Thespesia populnea, Pongamia pinnata, Bombax ceiba, Bytteneria* sp., *Dalbergia* sp., *Elaeocarpus* sp., *Grewia* sp., *Hibiscus* sp., *Ziziphus* sp.
95.	*Neptis hylas*	Common Sailor	*Xylia xylocarpa, Bombax ceiba, Helicteres isora, Mucuna pruriens, Nothapodytes nimmomiana, Vigna cylindrica, V. ungulata, Canavalia gladiata, Paracalyx scariosa, Corchorus* sp., *Grewia* sp., *Flemingia* sp., *Lathyrus* sp.
96.	*N. viraja*	Yellow Jack Sailor	*Dalbergia latifolia, D. racemosa*
97.	*N. columella*	Short Banded Sailor	*Dalbergia* sp.

98.	*Pantoporia hordonia*	Common Lascar	*Acacia instia, Albizia odoratissima*
99.	*Athyma nefte*	Colour Sergeant	*Glochidion velutinum,* G. *zeylanica, Mussaenda frondosa*
100.	*A. selenophora*	Staff Sergeant	*Adina cordifolia*
101.	*Athyma ranga*	Blackvein Sergeant	*Chionanthes mala –elengi, Olea dioica*
102.	*A. perius*	Common Sergeant	*Glochidion lanceolarum,* G. *velutinum, Phyllanthus* sp.
103.	*Limenitis procris*	The Commander	*Cadabafruticosa, Hedyotis orixense, Mitragyna Mussaenda frondosa, Neolamarckia cadamba,*
104.	*Parthenos sylvia*	Clipper	*Adenia hondala, Tinospora cordifolia*
105.	*Tanaecia lepidea*	Grey Count	*Careya arborea, Melastoma malabathricum*
106.	*E. aconthea*	Common Baron	*Anacardium occidentale, Mangifera indica, Loranthus scurrula, Trovhis aspera, Scurrula parasitica*
107.	*E. lubentina*	Gaudy Baron	*Anacardium occidentale, Bryonia* sp., *Mangifera indica, Morus* sp.
108.	*E. nais*	Red Baron	*Diospyros melanoxvlon, Shorea robusta*
109.	*Dophla evelina*	Red Spot Duke	*Anacardium occidantale, Diospyros condolleana, D. melanoxvlon*
110.	*Byblia iIithyia*	Joker	*Tragia plunkenetii*
111.	*Ariadne merione*	Common Castor	*Ricinus communis, Tragia involucrate, T. plukenetii*
112.	*Ariadne ariadne*	Angled Castor	*Ricinus communis, Tragia involucrate, T. plukenetii*
113.	*Libythea mvrrha*	Club Beak	*Celtis tetrandra*
114.	*Libythea lepita*	Common Beak	*Celtis tetrandra*
115.	*Junonia hierta*	Yellow Pansy	*Hygrophila auriculata, Barleria* spp.
116.	*Junonia orithya*	Blue Pansy	*Hygrophila auriculata, Lepidagathis prostrata, L. keralensis, Justicia neesii, J.procumbens*
117.	*Junonia lemonias*	Lemon Pansy	*Corchorus capsularis, Hygrophila auriculata, Sida rhombifolia, Cannabis sativa, Barleria* spp., *Nelsonia canescens*
118.	*Junonia almana*	Peacock Pansy	*Hygrophila auriculata, Phyla nodiflora, Barleria* sp., *Acanthus* sp.,*Gloxinia* sp.

119.	*Junonia atlites*	Grey Pansy	*Hygrophila auriculata, Barleria* spp.
120.	*Junonia iphita*	Chocolate Pansy	*Hygrophila auriculata, Carvia callosa, Justicia neesii*
121.	*Vanessa indica*	Indian Red Admiral	*Girardinia diversifolia, Urtica* spp.
122.	*Cynthia cardui*	Painted Lady	*Artemisisa sp., Blumea* sp., *Debregeasia bicolor, Gnaphalium* sp.
123.	*Kaniska canace*	Blue Admiral	*Smilax* sp., *Dioscorea* sp.
124.	*Cynthia cardui*	Painted Lady	*Artemissia* spp., *Blumea* spp.,*Debregeasia bicolor*
125.	*Hypolimnas bolina*	Great Egg-fly	*Laportea interrupta, Portulaca oleracea, Sida rhombifolia*
126.	*Hypolimnas misippus*	Danaid Egg-fly	*Portulaca oleracea, Abutilon* sp., *Abelmoschus* sp., *Asystasia lawiana, Barleria cristata, Hibiscus* spp.
127.	*Doleschalia bisaltidae*	Autumn-leaf	*Gratophvllum hortrense, Urtica sp.*
128.	*Kallima horsfieldi*	Blue Oak-leaf	*Carvia callosa, Strobilanthes callosus, Lepidagathis cuspidata*
129.	*Cyrestis thyodamas*	Common Map	*Ficus* spp.
130.	*Parantica aglea*	Glassy Blue Tiger	*Calotropis gigantea, Cryptolepis buchananii, Tylophora indica, T. tenuis, Ceropegia oculata, C. bulbosa, C. fantastica, Ceropegia* sp., *Vincaefolia* sp.
131.	*Tirumala limniace*	Blue Tiger	*Asclepias curassavica, Calotropis gigantea, Tylophora indica, Wattakaka volubilis, Hoya* sp.
132.	*Tirumala septentrionis*	Dark Blue Tiger	*Wattakaka volubilis, Vallaris heynei*
133.	*Danaus chrysippus*	Plain Tiger/Common Tiger	*Calotropis gigantea, Asclepias curassavica, Cryptolepis buchananii, Frerea indica, Caralluma adscendens*
134.	*Danaus genutia*	Striped tiger	*Asclepias curassavica, Ceropegia intermedia, C. oculata, C. fantastica, Tylophora tenuis, Stephanotis* sp.
135.	*Euploea core*	Common Indian Crow	*Ficus* sp., *Hemidesmus indicus, Cryptolepis buchananii, Tylophora indica, Mimusops elengi, Asclepias curassavica, Nerium oleander, N. odorum, Streblus asper, Carissa carandas*
136.	*E. klugii*	Brown King Crow	*Ficus* spp., *Ichnocarpus frutescens*
137.	*Idea malabarica*	Malabar Tree Nymph	*Aganosma cymosa, Parsonsia spiralis*
	LYCAENIDAE		

138.	*Abisara echerius*	Plum Judy	*Embelia robusta, Ardisia* sp.
139.	*Spalgis epius*	Ape fly	Scale insects or mealy bugs
140.	*Castalius rosimon*	Common Pierrot	*Ziziphus mauritiana, Z. rugosa, Z. xylopyrus*
141.	*Caleta caleta*	Angled Pierrot	*Ziziphus rugosa*
142.	*Discolampa ethion*	Blue Banded Pierrot	*Ziziphus mauritiana, Z. xylopyrus, Z. oenoplia*
143.	*Tarucus ananda*	Dark Pierrot	*Ziziphus xylopyrus, Dendrophthoe falcata*
144.	*T. nara*	Striped Pierot	*Ziziphus mauritiana*
145.	*Leptotes plinius*	Zebra Blue	*Albizia lebbeck, Plumbago zeylanica, Indigofera* sp., *Mimosa sp.,Dyerophytum indicum*
146.	*Azanus ubaldus*	Bright Babul Blue	*Acacia nilotica, A. leucocephala*
147.	*A. uranus*	Dull Babul Blue	*Acacia arabica, A.senegalensis*
148.	*A. jesous*	African Babul Blue	*Acacia farnesiana, A. leucophlea*
149.	*Everes lacturnus*	Indian Cupid	*Lotus corniculatus*
150.	*Actolepis puspa*	Common Hedge Blue	*Xylia xylocarpa, Schleichera oleosa, Paracalyx scariosa, Hiptage benghalensis, H. madablota, Cratoxylum ligustinum, Cyclista scariosa*
151.	*Neopithecops zalmora*	Quaker	*Glycosmis arborea*
152.	*Magisba malaya*	Malayan	*Allophylus cobbe, Erioglosum* sp., *Hemigyrosa* sp.
153.	*Pseudozizeeria maha*	Pale Grass Blue	*Nelsonia canescens, Oxalis corniculata, Strobilanthes* spp., *Tephrosia pauciflora*
154.	*Zizeeria karsandra*	Dark Grass Blue	*Amaranthus viridis, Zornia gibbosa*
155.	*Zizina otis*	Lesser Grass Blue	*Alysicarpus vaginalis, Sesbania bispinosa*
156.	*Zizula hylax*	Tiny Grass Blue	*Hygrophila auriculata, Lantana camara, Nelsonia canescens, Phaulopsis dorsiflora, Strobilanthes* sp.,*Viola* sp.
157.	*Freyeria trochylus*	Southern Grass Jewel	*Oxalis corniculata, Pisum sativum, Lotus corniculatus, Indigofera* sp., *Goniogyna hirta, Rhynchosia minima, Vicia* sp.
158.	*Euchrysops cnejus*	Gram Blue	*Butea monosperma, Ougeinia oojeinensis, Pisum sativum, Vigna cylindrica, V. trilobata, Paracalyx scariosa, Acacia* sp.
159.	*Catochrysops strabo*	Forget me not	*Desmodium sp., Ougenia oojeinesis, Paracalyx scariosa, Schleichera oleosa*
160.	*Lampides boeticus*	Pea Blue	*Butea monosperma, Pisum sativum, Vigna sinensis, Crotalaria* sp.

161.	*Jamides alecto*	Metallic Cerulean	*Eletaria cardamomum*
162.	*Jamides celeno*	Common Cerulean	*Abrus precatorius, Butea monosperma, Pongamia pinnata, Saraca asoca, Trichilia connaroides, Xylia xylocarpa, Elettaria cardamomum*
163.	*Nacaduba pactolus*	Large Four-line Blue	*Entada sp.*
164.	*N. kurava*	Transparent Six-line Blue	*Embelia robusta, Ardisia humilis, Waltheria indica*
165.	*N. beroe*	Opaque Six-line Blue	*Moulluva spicata*
166.	*Prosotas nora*	Comon Line Blue	*Acacia catechu, A. torta, Pithecalobium dulce* and few unspecified families Combertaceae, Myrtaceae and Sapindaceae
167.	*P. dubiosa*	Tail less Line Blue	*Acacia* sp., *Mimusa pudica, Leucaena* sp.
168.	*Jamides bochus*	Dark Cerulean	*(Butea monosperma) Millettia peguensis, Crotalaria* sp., *Pongamia pinnata, Tephrosia candidas*
169.	*Talicada nyseus*	Red Pierrot	*Kalanchoe pinnata, K. laciniata*
170.	*Arhopala pseudocentaurus*	Western Centaur Oak Blue	*Lagrestoemia microcarpa, L. reginae, Terminilia alata, T. paniculata, T. catappa, Xylia xylocarpa, Hopea jucunda*
171.	*A. amantes*	Large Oak Blue	*Lagrestoemia microcarpa, Schleichera oleosa, Terminilia alata, T. paniculata, Xylia xylocarpa*
172.	*A. abseus*	Aberrant Oak Blue	*Shorea robusta*
173.	*Thaduka multicaudata*	Many tailed Oak Blue	*Trewia nudiflora*
174.	*Surendra quercetorum*	Common Acacia Blue	*Acacia polycantha, Acacia instia*
175.	*Iraota timoleon*	Silver Streak Blue	*Ficus bengalensis, F. racemosa, F. religiosa, Punica granatum*
176.	*Amblypodia anita*	Leaf Blue	*Olax imbricate, O. scandens*
177.	*Spindasis vulcanus*	Common Silver-line	*Allophylus cobbe, Canthium coromandelicum, Ziziphus mauritiana, Clerodendrum inerme Cadaba fruticosa, C. indicum*
178.	*S. lohita*	Long-banded Silver-line	*Discorea pentphylla, Terminalia paniculata, Xylia xylocarpa*
179.	*Catapaecilma major*	Common Tinsel	*Terminalia paniculata*
180.	*Loxura atymnus*	Yam-fly	*Dioscorea pentaphylla, Smilax* sp.
181.	*Cheritra freja*	Common Imperial	*Xylia xylocarpa, Saraca asoka, Ixora sp.*

			Cinnamomum sp.
182.	*Rathinda amor*	Monkey Puzzle	*Ixora coccinea, Eugenia zeylanica, Hopea* sp., *Loranthus* sp.
183.	*Horaga onyx*	Common Onyx	*Coriaria nepalensis*
184.	*H. viola*	Violet Onyx	*Coriaria nepalensis*
185.	*Zesius chrysomallus*	Red spot	*Terminalia paniculata, Anacardium occidentale, Psidium guava, Pterocarpus marsupium*
186.	*Zeltus amasa*	Fluffy Tit	
187.	*Rapala manea*	Slate Flash	*Antidesma acidum, A. ghaesembilla, Camelia sinensis, Quisqualis indica, Ziziphus sp.,Acacia pennata, A. torta, A. megaladena*
188.	*Curetis thetis*	Indian Sun beam	*Abrus precatorius, Pongamia pinnata, Derris scandens, Xylia dolabriformes*
189.	*Thoressa honorei*	Madras Ace	Bamboos
190.	Tajuria cippus	Peacock Royal	Dendrophthoefalcata, Helicanthus elastica, Helixanthera
191.	T. melastigma	Branded Royal	Helicanthes elastica
192.	*H. othona*	Orchid Tit/Orchard	*Cottonia macrostaschys, Aerides crispum, Rhynchostylis retusa*
193.	*Zeltus amasa*	Fluffy Tit	*Orchidaceae plants*
194.	*Deudorix epijarbas*	Carnelian	Punica granatum, Cannarus ritchiei, Aesculus in dicus,
195.	*D. isocrates*	Common Gauva	Inside the fruits of *Punica wanatum* and *Psidium fava*
196.	*D. perse*	Large Gauva Blue	Fruits of *Randia dumetorum*
197.	*Blindahara phocides*	Plane	Within the fruits of Salacia macrosperma, S. reticulata

198.	*Rapala iarbus*	Indian Red Flash	*Litchi* sp., *Ougnia oojeinensis, Zizyphus rugosa, Rubus* sp.
199.	*Rapala manea*	Slate Flash	Acacia megaladena, A. pennata, A. torta, Antidesma acidum, A. ghaesembilla, Camelia sinensis
200.	*Rapala varuna*	Indigo Flash	*Lantana camara, Qyuisqualis indica, Sapindus laurifolia, Ziziphus rug!osa, Z. xylopyrus*
201.	*Curetis thetis*	Indian Sunbeam	*Pongamia pinnata, Derris scandens, Abrus precatorius, Xylia xylocarpa, Trichilia connaroides*
202.	C. *siva*	Shiva Sunbeam	*Ougenia dalberoides, Desmodium oogenense*
	HESPERIIDAE		
203.	*Hasora chromus*	Common Banded Awl	*Pongamia pinnata, Ricinus communis, Trichilia connaroides*
204.	*Hasora taminatus*	White – banded Awl	*Derris scandens, Pongamia pinnata*
205.	*H. vitta*	Plain Banded Awl	*Milettia extensa, M vallida*
206.	*Badamia exclamationis*	Brown awl	*Terminalia bellerica, Combretum latifolium, C. albidium, Linociera* sp.
207.	*Celaenorrhinus leucocera*	Common spotted flat	*Carvia callosa, Ecbolium ligustrinum, Eranthemum roseum, Thelepaepale ixiocephala*
208.	C. *ambareesa*	Malabar Spotted Flat	*Carvia callosa, Daeda-Iacanthus purpura-scens, Eranthemum roseum*
209.	C. *ruficornis*	Tamil Spotted Flat	*Carvia callosa*
210.	*Tagiades obscurus*	Immaculated / Suffused Snow Flat	*Dioscorea oppositifolia*
211.	*T. gana*	Suffused Snow	*Dioscorea oppositifolia*
212.	*Tagiades litigiosa*	Water Snow Flat	*Dioscorea oppositifolia, Dioscorea* sp.
213.	*Pseudocoladenia dan*	Fulvous Pied Flat	*Achyranthes aspera*
214.	*Sarangesa desahara*	Common Small Flat	*Asystasia* sp., *Blepharis asperima*
215.	*Sarangesa purendra*	Spotted Small Flat	*Asystasia* sp.
216.	*Odontophilium angulata*	Banded/Chestnut Angle	*Allophylus cobbe, Ceiba pentandra, Hibiscus tiliaceus, Urena lobata*
217.	*0. ranosonnetti*	Golden Angle	*Helicteres isora*

218.	*Spialia galba*	Indian Grizzled Skipper	*Sida rhombifolia, Hibiscus sp., Waltheria indica*
219.	*Halpe homolea*	Indian Ace	Bamboos
220.	*Gomalia elma*	African marbled or mallow Skipper	*Abutilon indicum*
221.	*Psolos fuligo*	Coon	*Stachyphrynium spicatum*
222.	*Notocrypta paralysos*	Common Banded Demon	*Curcuma* sp., *Zingiber* sp.
223.	*Notocrypta curvifascia*	Restricted Demon	*Costus speciosa, Hedychium coronarium, Kaempferia rotunda, Zingiber montana, Curcuma decipiens*
224.	*Udaspus folus*	Grass Demon	*Curcuma aromatia,* C. *decipiens, Hedychium* spp.
225.	*Suastus gremius*	Indian Palm Bob	*Calamus spp.,. Caryota urens, Cocos nucifera, Phoenix acaulis, P. lourierii*
226.	*Cuphita purrees*	Wax Dart	*Combretum ovalifolium, Terminalia bel/erica, T. paniculata, Ehretia laevis*
227.	*Baracus vittatus*	Hedge Hopper	Grasses
228.	*Hyarotis adrastus*	Tree Flitter	*Phoenix aculis, Palms*
229.	*Gangara thyrsis*	Giant Red Eye	*Calamus rotang, Caryota urens, Cocos nucifera, Phoenix acaulis, P. loureii, Licuala grandis, Ornamental palms*
230.	*Erinota thrax*	Palm Red Eye	*Cocos nucifera, Musa saDientium Saccharum* sp.
231.	*Matapa aria*	Common Red Eye	*Bambus arundinacea*
232.	*Taractrocera maevius*	Common Grass Dart	Grasses
233.	*T. ceramas*	Tamil Grass Dart	*Oryza sativa* and other grasses
234.	*Oriens gola*	The Common Dartlet	Grasses
235.	*Potanthus pallida*	Pallid Dart	*Oryza* spp., *Sacharum* sp., Bamboos
236.	*Telicota colon*	Pale Palm Dart	Oryza *spp*., Sacharum *sp., Bamboos*

237.	*T. ancilla*	Dark Palm	*Oryza* spp., *Sacharum* sp., Bamboos
238.	*Barbo cinnara*	Rice Swift	*Andropgon* sp., *Cymbopogon* sp., *Eragrostis* sp.
239.	*B. bevani*	Bevan's Swift	*Imperata cylindrica, Paspalum conjugatum, Saccharum* spp.
240.	*Pelopidas mathias*	Small Branded Swift	Grasses
241.	***P****. coniuncta*	Conjoined Swift	Bamboos and Grasses
242.	*Polvtermis lubricans*	Contiguous Swift	Grasses
243.	*Baoris farri*	Paintbrush Swift	Bamboos
244.	*Caltoris kumara*	Blank Swift	Grasses

Appendix 11. List of butterflies sighted in the garden

PAPILIONIDAE

Troides minos Cramer*

Pachliopta hector Linnaeus *+

Pachliopta aristoloehiae Fabricius

Papilio paris Linnaeus

Papilio buddha Westwood*+

Papilio crino Fabricius

Papilio demoleus Linnaeus

Papilio helenus Linnaeus

Papilio polytes Linnaeus

Papilio polymnestor Cramer*

Papilio liomedon Moore*+

Chilasa clytia Linnaeus +

Graphium sarpedon Linnaeus

PIERIDAE

Leptosia nina Fabricius

Delias eucharis Drury*

Appias libythea Fabricius+

Catopsilia pyranthe Linnaeus

Catopsilia pomona Fabricius

Eurema hecabe Linnaeus

Eurema blanda Boisduval

ACRAEIDAE

Acraea violae Fabricius

SATYRIDAE

Melanitis leda Linnaeus

Mycalesis anaxias Hewitson +

Elymnias caudata Butler

NYMPHALIDAE

Cupha erymanthis Drury

Junonia lemonias Linnaeus

Junonia atlites Linnaeus

Junonia almana Linnaeus

Neptis hylas Moore

Hypolimnas bolina Linnaeus

Hypolimnas misippus Linnaeus +

Moduza procris Cramer

Euthalia aconthea Cramer

Ariadne merione Cramer

LYCAENIDAE

Jamides celeno Cramer

Jamides alecto Felder

Talicada nyseus Guerin-Meneville

Loxura atymnus Cramer

Rathinda amor Fabricius

HESPERIDAE

Tagiades litigiosa Moschler

Celaenorrhinus leucocera Kollar

Pelopidas mathias Fabricius

Badamia exclamationis Fabricius

Gangara thyrsis Fabricius

DANAIDAE

Danaus genutia Cramer

Danaus chrysippus Linnaeus

Tirumala Iimniace Cramer

Tirumala septentrionis Butler

Parantica aglea Stol

Euploea core Cram.+

+ Species included in the Wildlife (Protection) Act, 1972

* Species endemic to Western Ghats