

**DIVERSITY OF BUTTERFLIES IN THE  
THANKOT AND SYUCHATAR VDCs  
OF KATHAMNDU DISTRICT**

*A thesis submitted in partial fulfillment of the requirement for the  
master's degree of science in zoology with entomology as special  
paper*

Submitted by  
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Submitted to  
Central department of zoology  
Institute of science and technology  
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Kirtipur, Kathmandu  
Nepal  
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## **CENTRAL DEPARTMENT OF ZOOLOGY**

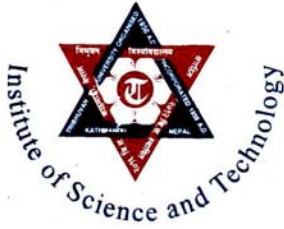
Kirtipur, Kathmandu, Nepal.

### **CERTIFICATE OF APPROVAL**

On the recommendation of Mr. Daya Ram Bhusal, Lecturer and Supervisor this dissertation work of Miss Gita Thapa entitled “Diversity of butterflies in the Thankot and Syuchatar VDCs of Kathmandu district” is approved for the examination and submission in partial fulfillment of the requirement for the degree of Science in Zoology with Entomology as a special paper.

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### **RECOMMENDATION**

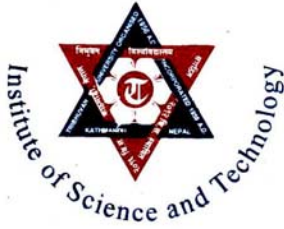
It is recommended that Miss Gita Thapa has completed her dissertation work entitled DIVERSITY OF BUTTERFLIES IN THE THANKOT AND SYUCHATAR VDCs OF KATHMANDU DISTRICT as a partial fulfillment of the requirement for Master's Degree in Zoology under my supervision. The entire work is based on the information collected by her in the field as well as laboratory and results have not yet been published or submitted for any other degree.

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TRIBHUVAN UNIVERSITY

01-4331896

# CENTRAL DEPARTMENT OF ZOOLOGY

Kirtipur, Kathmandu, Nepal.

Ref.No.:

Date\_\_\_\_\_

## CERTIFICATE OF APPROVAL

The M.Sc. dissertation work entitled “Diversity of Butterflies in the Thankot and Syuchatar VDCs of Kathmandu District” has been accepted as a partial fulfillment of the requirements for M.Sc. degree in Zoology with Entomology as a special paper.

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Gita Thapa

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## ABSTRACT

Diversity of butterflies was studied in Thankot and Syuchatar VDCs of Kathmandu District, Nepal during June 2007-March 2008. The main objectives were to study the diversity, seasonal variation and habitats of butterflies. Equipments like insect net, insect pin, preservatives, paper envelopes, stretching board and insect box were used. After trapping, the butterflies were killed by pressing the thorax dorsoventrally. Relaxing was done by either injecting hot water or placing over moist sand and stretched on a stretching board, pinned with insect pins. They were then preserved in an insect box. A total of 43 species of butterflies belonging to 32 genera and 9 families were recorded with Nymphalidae as the most commonly recorded Family and Libytheidae and Acreidae as the least recorded families. Species richness increased with upcoming warmer summer days while decreased with cold and dry winter days. Most of the species were collected in summer and very few in winter season. Bushes, cultivated land, open field and forest were selected to study the habitats of butterflies. Bushes were found to be the most preferable habitat. Some species were common to all the four habitats. Color variation was also observed in some species. Three species namely *Ypthima baldus*, *Ypthima nareda* and *Precis iphita* showed color variation. Although Thankot and Syuchatar harbors many species of butterflies but their habitats are being destroyed due to urbanization. So a strong measure has to be taken to protect and conserve these species.

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Key words: Acreidae, diversity, Libytheidae, Nymphalidae, seasonal variation, species richness.

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## Chapter-I

### INTRODUCTION

#### 1.1 Background

Biodiversity means variation of life at all levels of biological organization, a measure of the relative diversity among organisms present in different ecosystems. It includes diversity within a species and among species, and comparative diversity among ecosystems (Rosen, 1985).

Butterflies (Athropoda; Insecta; Lepidoptera) belong to Rhopalocera and fifteen families. It is in this order that coloration has reached highest degree of specialization. Butterflies are diurnal in habit and are generally categorized by their colorful wings, clubbed antennae and spirally coiled proboscis, females are usually larger than males.

Butterflies play very important role in nature and therefore they have always been popular objects for study. They have been studied for aesthetic value as well as economic value. They are known for their active role in plant pollination, used as forest health indicators which mean that the health and condition of a particular plant species can be determined. The larval stages of some species of butterflies are pests and devour foliage and shoots of trees and crops. They are also used to determine the climate of a particular place which implies that they can be used as climate indicators (Crozier, 2004). Butterflies prefer warm weather because they need sunlight to generate enough body heat in order to fly. They require a constant short and long day lengths to remain reproductive.

The climate of Nepal is very diverse with tropical and subtropical climate to sub alpine and alpine. Climatic, physical and ecological diversity makes Nepal a meeting place for many and even rare species of butterflies.



Of all the insect types of Nepal probably butterflies have the oldest collection record. General Thomas Hardwickii started the first collection of butterflies in Nepal in 1826. Nepal houses excellent representation of butterflies found both in oriental and Palaearctic realms. The total diversity of butterflies reported so far comprises about 650 species out of 20,000 species found in the world.

The valley floor of Kathmandu and its surrounding mountains display more than 360 species of butterflies of different status level. *Teinopalpus imperialis*, *Papilio krishna*, *Diagora nicevillei*, *Troides aeacus*, etc. are the notable species found in Kathmandu. About 29 species and subspecies have been found endemic to the country (Smith, 1993).

About 20 species of Kathmandu valley have been listed as endangered or vulnerable. Four very attractive butterflies of Kathmandu that are under threat level include *Teinopalpus imperialis*, *Meandrousa gyas*, *Papilio krishna* and *Euripus consimilis*. Similarly *Phaedyma aspasia Kathmandia* is the endemic subspecies reported from Godawari, southern part of Kathmandu valley. Species like *Amblopala avadiena nepalica* is the next endemic subspecies reported from the Nagarjun forest of the northwest Kathmandu (BPP, 1995).

## 1.2 Study Areas

- i) Thankot- Thankot is located in the western side of Kathmandu valley (27° 40' 60N, 85° 10' 60E) which is about 11 km from Ratnapark. High altitude regions are mostly covered with thick forests. Thankot is one of the Village Development committee (VDCs) of Kathmandu district and the study area was confined to ward no.8 and 9. This region receives maximum rainfall during rainy season and sometimes it can go up to 100cm. The average temperature of this region ranges from 28° to 30° C. The total area of this site is about 6 sq kms (Approx.)



**Study site 1. Syuchatar**



**Study site 2. Thankot**

- ii) Syuchatar- Syuchatar is located in the south western side of Kathmandu valley ( $27^{\circ} 41' 59''\text{N}$ ,  $85^{\circ}10' 39'' \text{ E}$ ) which is about 2-3 kms from Ratnapark. This VDC is about 10 km away from Thankot VDC and the study areas included ward no.6, 7, 8 and 9. The total area of this site is about 2.sq kms (Approx)

### **1.3 Vegetation of the study areas**

The vegetation of both the VDCs is mixed forest type. The dominant species are large and medium sized trees of *Pinus roxburghii*, *Myrica esculentat*, *Castanopsis indica*, and *Schima wallichii*. Among the shrubs are *Eupatorium adenophorum*, *Rubus ellipticus* and *Duranta indica*. The forests of Syuchatar also harbor red *Rhododendron* species. Present study area includes tremendous variations in forest conditions (dense, bushy, cultivated and open grassland and forest) such variations represent good diversity of butterfly species (Smith, 1994). The land is mostly used for the cultivation of crops like rice, maize and vegetables (cabbage, cauliflower, carrot, grain legumes, radish, spinach etc.).

### **1.4 Justification of the study**

Most of the research works on butterflies have been confined to other important parts of Nepal. So these areas (Thankot and Syuchatar) remained untouched. Due to urbanization most of the butterfly habitats have been destroyed. Therefore, this study is a small attempt to study the diversity of butterfly species of these areas before they become extinct without even knowing their existence.

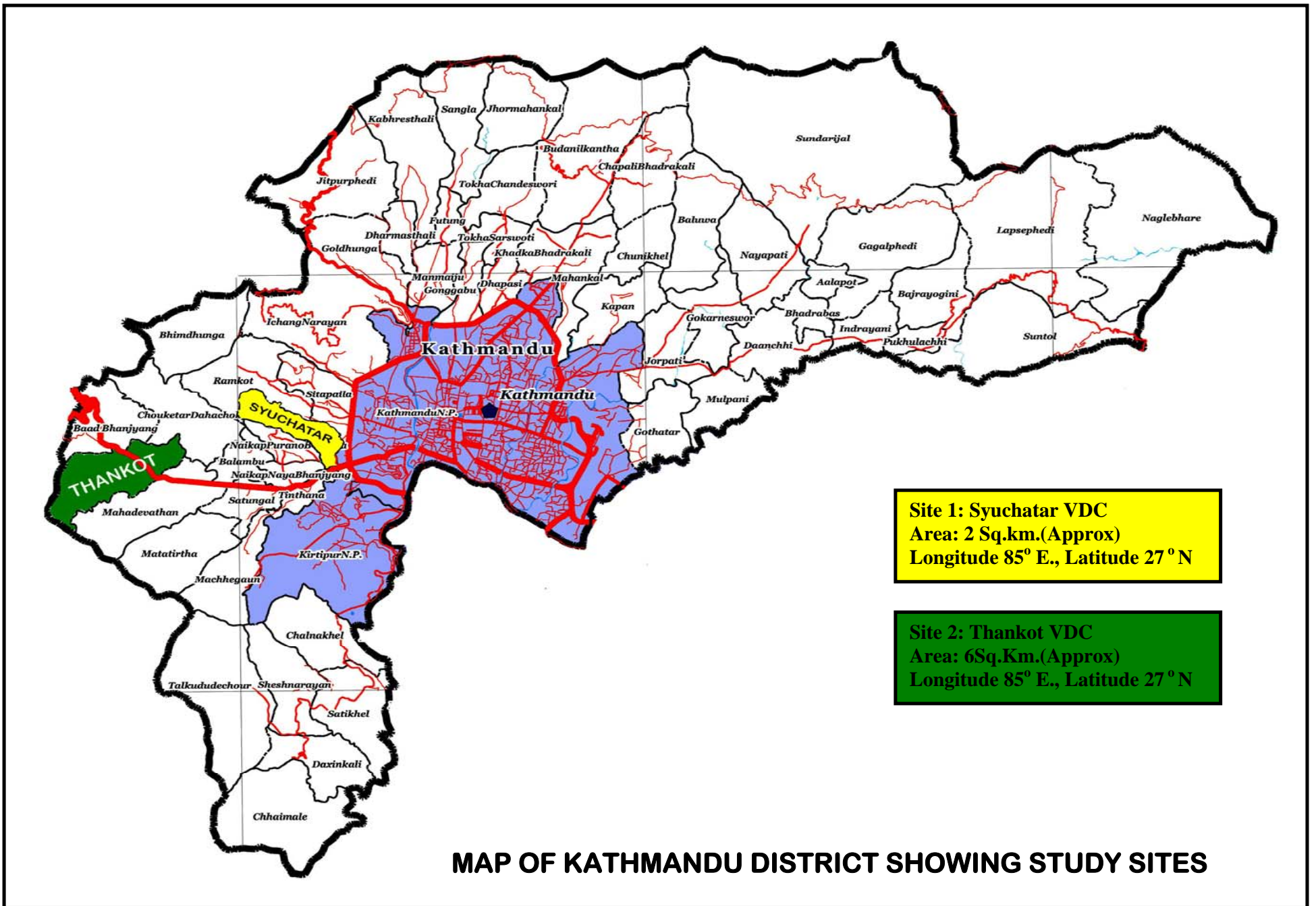
### **1.5 Limitations of the study: -**

- i) An elaborated study could not be made because this study is only for the partial fulfillment of the requirements for the degree of Master of Science
- ii) It was constrained by monetary problem.

### **1.6 Objectives of the study**

The objectives of this study were:

- i) To study the diversity of butterfly species.
- ii) To assess the seasonal variation of the butterfly species.
- iii) To compare the habitats for butterflies.



**MAP OF KATHMANDU DISTRICT SHOWING STUDY SITES**

## **Chapter-II**

### **REVIEW OF LITERATURE**

#### **2.1 LITERATURE REVIEW IN CONTEXT OF NEPAL**

Altogether 17,500 species of butterflies have been estimated to exist in the world (Global Biodiversity, 1992). But today about 20,000 species of butterflies are known to exist in the world (Fox *et al*, 2007). In Nepal, study of butterfly was started from 1826 (Khanal and Smith, 1997).

The first known butterfly collector in Nepal was General Thompson Hardwick (1826). There after Maj. Gen. Ramsey, a British resident while being deputed in Kathmandu made some contributions during 1852-67 on this field and collected 44 species.

Bailey (1951) made a remarkable study of butterflies of Nepal. His findings were published in the Bombay Natural History Society Journal which included a total of 196 species. This comprises of 31 species from Papilionidae, 35 species from Pieridae, 11 species from Danaidae, 44 species from Satyridae, 1 species from Amathusidae, 75 species from Nymphalidae, and one species from Acreidae.

Igarashi (1963), a Japanese national was able to observe and draw the picture of immature stages of 16 species of butterflies from Nepal which is reported in the special bulletin of Lepidopterological Society of Japan (No.1, 2).

Smith (1975) recorded 100 genera of common butterflies of Nepal in a bulletin series published from Natural History Museum, Tribhuvan University. He (1977) further recorded 8 new species of butterflies from Godawari and 26

species from eastern Nepal. Shrestha and Smith (1977) studied variation among Nepal's butterfly. In 1978 Smith listed 565 species of butterflies including 21 additional species. Finally it was 1982 when he made a list of 480 species in the Natural History Museum Bulletin series II.

Khanal (1982) reported 97 species of butterflies under 61 genera from Lamjung and Manang districts. In the same year Khanal and Bhandari (1982) studied the food plants of some butterfly larvae. Again Khanal (1984) reported 21 new species of butterflies from Lamjung and Manang districts of Nepal and in 1985 he studied the butterflies of Gorkha and Trisuli regions, and recorded a total of 52 species and in the same year thirty-nine species of butterflies were recorded from Piper, Kaski district. In 1987 he reported 50 species of butterflies from Pokhara Muktinath trek. Nepali and Khanal (1988) reported 26 species of butterflies under 6 families from Dolpa and Manang districts.

Smith (1989) published a book mentioning 614 species of butterflies existing in Nepal of which 43 species were Papilionids, 49 species Pierids, 173 species Lycaenids, 2 species Labytheids, and 107 species of Hesperids. 82 species Satyrids and 15 species of Danaids. In 1990, he described 266 species of beautiful butterflies of Nepal, but in the same year he was suspecting more than 643 species of butterflies from Nepal.

Giri (1991) reported 117 species of butterflies representing 68 genera and eight families from Sankhuwasabha district.

Smith (1996) studied butterfly diversity in Nepal where he found disproportionately large number of species distributed in this small country. The reasons he gave were the varieties of habitat, zoogeographic regions and undisturbed habitat.

Thapa (1998) listed 656 species of butterflies under 286 genera in his “An inventory list of Nepal’s insects Lepidoptera vol. 2” and mentioned genus *Orinoma gray* (1846) and one of its sub species as endemic to Nepal.

Khanal (1999) brought out a list of 71 species of butterflies of Kailai and Kanchanpur districts of far western part of Nepal. These species have been categorized under eight families.

Bhusal D. R (2001) recorded a total of 40 species of butterflies belonging to 28 genera and eight families from Churiya range of eastern Nepal ranging in altitude from 250-1150m with Nymphalidae as the highest recorded Family.

Ghimire U. R (2001) reported a total of 43 species of butterflies belonging to 29 genera and 43 species from Champadevi, District Kathmandu with Nymphalidae as the highest and Acreidae as the rarest families.

Subba B. R. (2005) reported a total of 41 species of butterflies belonging to 31 genera under 7 families from Gujurmukhi village development committee, Ilam, eastern Nepal. He also reported Nymphalidae as the highest recorded family.



## 2.2 Literature Review in Context of the World

According to Sanders (1955) the recorded distribution of several butterflies of Indian region is too circumscribed. He also mentioned significant information about habit and habitats of many species. His study included the species diversity in India and Pakistan. He presented a precise list of 115 species and some of them do not exist in Nepal. An account of *Parnassius* species which occur in higher elevations has been presented in his publication.

Donahue (1967) made a very good study of butterflies in Delhi, India. Based on his study, 77 species of butterflies have been reported in Delhi. Besides, 32 other species which have been recorded from neighboring localities that may yet to be found in Delhi.

Braby (1990) studied the biology and life history of *Paralucia pyro discus lucida* (Lepidoptera; Lycaenidae) of Australia. Details of the life cycle of *P.p.lucida* are presented and compared with those of other species of *Paralucia*. In 1993, he studied the juvenile stages, biology and taxonomic stages of *Tisiphone helena* (Lepidoptera: Nymphalidae: Satyrinae) and compared with those of *T. abeona* in Queensland. In 1994, he studied the morphology and early stages of *Mycalesis pesseus*, *M. terminis*, *M. sirius* (Lepidoptera Nymphalidae) from north eastern Australia. In 1995, he studied the geographic relative abundance and habitat association of tropical Satyrine butterflies of north eastern Australia. And in 1996, he described a new species of *Nesolycaena medicea* (Lepidoptera: Lycaenidae) from northern Queensland. The genus as currently defined contains four species.

According to Pullin (1996) butterflies have declined rapidly in both distribution and abundance in Britain and the most common reason is due to unsuitability of the habitat or lack of knowledge of the species requirement.

Braby (1997) studied the occurrence of *Eurema alitha* in Australia and its distinctiveness from *E.hecabe* in male genitalia.

Schultz (1998) studied the dispersal behavior of Fender's blue butterfly of Oregon (U.S.A) and concluded that to identify reserve design strategies for an endangered species it is important to understand the dispersal behavior of the species. He studied the flight and daily activity patterns of this rare Oregon butterfly

Webb and Pullin (2000) studied the distribution and abundance *Lycaena dispar* eggs in Netherlands. The large copper butterfly, *Lycaena dispar batavus* is host specific to the water dock *Rumex hydrolapathum*. Host plant selection for oviposition showed no significant relationship with physical plant characteristics.

Pieloor and Seymour (2001) studied the mechanism responsible for initiation of reproductive diapause in the butterfly *Hypolimnas holina* from Australia. The diapause was independent of photoperiod and was actually modified by the weight of the developing larvae.

Krenn *et al.* (2001) studied the proboscis of flower visiting butterflies (Lepidoptera: Nymphalidae) of Austria and found that they are characterized by a slender, darker colored proboscis with a rather short tip region bearing fewer sensilla styloconia whereas the proboscis of non-flower visiting butterflies possess a relatively short and light colored proboscis which has a long tip region with a great number of club shaped sensilla styloconia.

Noack (2002) prepared an up to date checklist of butterflies of Perlis State Park, Peninsular Malaysia. The survey added 70 new records for the Perlis State Park checklist bringing the total up to 178.

Zhidanko (2003) described a new species *Plebejus dzhizak* (Lepidoptera: Lycaenidae) closely related to *P. argus* from Dzhizak province, Uzbekistan.

According to Mikkola (2003), ornithologists in Finland recorded migration of half a million butterflies over 100 km front and concluded that *Danaus plexippus* is the only butterfly which is known for its high elevation return migration on northerly winds.

Collinge *et al.* (2003) studied the effects of local habitat characteristics on all plants and animals in Colorado (U.S.A). Diversity of butterfly depends on the quality and type of grassland community. High quality grassland supported significantly higher butterfly species whereas low-quality supported fewer species.

Uniyal (2004) studied the butterflies of Nanda Devi National Park in India. This Park was declared as a world heritage site by the United Nations in December 1988. The author documented 35 butterfly species belonging to 25 genera and four families.

Koh *et al.* (2004) laid the importance of reserves, fragments, and parks for butterfly conservation in tropical urban landscapes of Singapore. According to the author, in urban landscape, forest reserves and urban parks should be given highest priority and urban parks should be revegetated with a diversity of potential larval host plant and should be situated as near as possible to a forest in order to maximize their conservation value.

Koh *et al.* (2004) devised ecological correlates of extinction proneness in tropical butterflies in Singapore. Among the various correlates, specificity of larval host plant and adult habitat specialization were the best correlates of extinction risk. These correlates could be used to estimate extinction threats for other taxonomic groups also.

Singh and Pandey. (2004) devised a model for estimating butterfly species richness of areas across Indian subcontinent and found that it is possible to use the species total of a single butterfly family to estimate the overall species richness of all other butterfly in an area. Also the mean proportion of this family (7:1) can be used to estimate the overall butterfly species richness of an area across the Indian sub-continent.

Thomas et al (2004) compared the losses of butterflies, birds and plants in Britain and found that butterflies had the greatest loss. And if the extinction of vertebrates and plant species go parallel with extinction of invertebrates then the hypothesis that the world is experiencing the sixth major extinction event would become even stronger.

Dutra *et al.* (2005) made a floristic study of Papilionidae in *Campos ferruginosos* in Brazil. *Desmodium*, *Crotalaria*, *Machaerium* and *Stylosanthes* were recorded to have more representative number of Papilionid species.

Luo *et al.* (2005) studied the relationship between diversity of butterflies and vegetation resources in China and found that the diversity of butterflies had relationship with the diversity of vegetation resources.

Kotiaho *et al.* (2005) in America predicted the risk of extinction of species of butterflies from shared ecological characteristics. They constructed an ecological risk rank which predicted the extinction risk of non threatened species

Byun *et al.* (2005) studied the butterfly fauna of Gwangneung Forest in Korea. A total of 148 species of butterflies were listed. Of them eight species were newly added.

Stankiewicz *et al.* (2005) described the first record of *Myrmica rugulosa* (Hymenoptera: Formicidae) as a host ant of *Maculinea rebeli* (Lepidoptera: Lycaenidae) in south Poland. This ant was never recorded as a host of the *Maculinea* butterfly.

Xiaoling and Wang (2006) described a new species of the genus *Coladenia* belonging to the family HesperIIDae from China. The new species *C. neomaeniata* was illustrated from Weixi County, Yunnan Province, China, and is closely allied to *C. maeniata* but differs in the hind wing and male genitalia.

Li-Xin *et al.* (2006) made a study on species diversity of butterflies in Langyashan National Forest Park in China. A total of 4454 specimen were collected and 57 species of 40 genera belonging to six families were identified. The study indicated that the species were abundant and the ecosystem of Langyashan Mountain was relatively intact.

Parsons *et al.* (2006) studied chestnut (*Castanea sativa*) as a food plant for Lepidoptera in Britain. Seventy species of Lepidoptera were recorded utilizing sweet chestnut as a food plant demonstrating it to be an under-valued and important host plant.

According to Dennis and Sparks (2007) abundance of Lepidoptera in Britain decreases significantly with decreased temperature during winter and rainy seasons and increases with increased temperature in summer season.

Komonen *et al.* (2008) studied the population structure and turnover of the butterfly species *Scolitantides orion* (Lepidoptera: Lycaenidae) in a lake-island in Finland and found that the high patch occupancy and balanced population turnover indicates that the metapopulation is not in immediate risk of extinction.

Stjernholm and Karlsson (2008) studied flight muscle breakdown of butterflies in Sweden. They observed that in case of female *Pieris napi* (Lepidoptera: Pieridae) mass and nitrogen content of the two most important groups of flight muscles each decreased by more than 80% over their adult life span.

## Chapter-III

### MATERIALS AND METHODS

#### 3.1 Materials

Materials and methods used in collection, preservation and identification of butterflies:

- a) Insect net- an insect net was used to collect the butterfly species. The handle (0.75) of this net was made up of steel. The rim (12inch diameter) was also made of a heavy steel wire. The rim could be joined with the handle by screw so that the rim and the handle can be separated when not in use. The net itself was made of a muslin cloth of fine mesh (1mm<sup>2</sup>) which was about twice as long as the diameter of the rim so that it could be closed over the frame to avoid the escape of the catch.
  
- b) Paper envelopes- paper envelopes were used to keep the specimen.
  
- c) Insect-pin- specimens were pinned with entomological pins. Large pins (4, 5) were used for large butterflies like those belonging to papilionidae whereas small numbered pins (1, 2) were used for pinning small butterflies like those belonging to lycaenidae and hesperidia.
  
- d) Preservatives- preservatives like naphthalene balls were used to protect the specimens from moulds and fungi. Silica gel was used to absorb moisture in the box.
  
- e) Stretching board- specimens were stretched on a stretching board. It was a wooden board with a groove in the centre. On top and bottom there were screws to adjust the groove.

g) Insect-box – after stretching the pinned specimens were kept in a triangular wooden boxes (45cx30cm).

### **3.2 Methods:**

The methods include the following steps:

a) Collection technique -the butterflies were collected from different habitats like the open fields, cultivated areas and forests. Butterflies were collected from June 2007 to March 2008 which included Spring, Summer and Winter seasons.

b) Killing technique - after trapping the butterflies into the net, their thorax were pressed carefully dorsoventrally from below in order to kill them. The dead specimen were then carefully transferred into the triangular paper envelops. The small specimen into smaller and large specimen into larger envelops.

c) Relaxing technique- larger specimens (Papilionidae) were relaxed by injecting hot water on either side of their thorax, hot water relaxed and made their bodies softer and then it was set .Smaller specimen were relaxed by placing them over a moist sand. Moist sand was kept on a Petridish, the paper containing the specimen were kept on it and covered with a lid. The moist sand relaxed their bodies and then it was set.

d) Setting technique- after relaxing the specimen were pinned with entomological pins and stretched on stretching board.

e) Preservation technique- the stretched specimens were preserved on wooden boxes. Naphthalene balls were placed at the corners of the box.



f) Identification- the collected specimens were identified by studying their external morphological characters like size, colour patterns and spots, shape of wings and tails, legs, claws and antennae (Wynter and Blyth 1957, Smith 1993, Khanal and Smith 1997). These were reconfirmed at the Natural History Museum Swayambhu, Kathmandu.

**Chapter-IV**  
**RESULTS AND DISCUSSION**

**4.1 Description of butterflies**

**Nymphalidae**

***Aglais cashmirensis* (Kollar, 1844)**

Common name: The Indian Tortoiseshell

Fig. 1.13

Wing span: 5cm

Date of collection: 09. 12. 2007

Locality: Godam, Thankot

Status: \*\*\*

Habitat: Open fields, bushes and cultivated lands.

***Athyma selenophora* (Kollar, 1844)**

Common name: Staff Sergeant

Fig. 1.14

Wing span: 5cm

Date of collection: 19. 07. 2007

Locality: Godam, Thankot

Status: \*

Habitat: Bushes and forests.

***Cethosia biblis* (Drury, 1773)**

Common name: The Red Lacewing

Fig. 1.16

Wing span: 65-90mm

Date of collection: 14. 09. 2007

Locality: Godam, Thankot

Status: \*

Habitat: Bushes and forests.

***Neptis hylas* (Linnaeus, 1758)**

Common name: The Common Sailor

Fig. 1.9

Wing span: 5cm

Date of collection: 25. 02. 2008

Locality: Syuchatar Ward No. 8

Status: \*\*\*

Habitat: Cultivated lands, bushes, open fields and forest.

***Phalanta phalanta* (Drury, 1773)**

Common name: The Common Leopard

Fig. 1.10

Wing span: 5cm

Date of collection: 13. 03. 2008

Locality: Syuchatar Ward no.7

Status: \*\*\*

Habitat: Bushes, open fields and cultivated lands.

***Precis almana* (Linnaeus, 1758)**

Common name: The Peacock Pansy

Fig. 1.8

Wing span: 60 65mm

Date of collection: 14. 08. 2007

Locality: Syuchatar ward no.7

Status: \*\*

Habitat: Forest and bushes

***Precis hierta* (Fabricius, 1798)**

Common name: The Yellow Pansy

Fig. 1.24

Wing span: 50-60mm

Date of collection: 30. 06. 2007

Locality: Syuchatar, ward no.6

Status: \*\*

Habitat: Open fields, cultivated lands and bushes.

***Precis iphita* (Cramer, 1779)**

Common name: The Chocolate Pansy

Fig. 1.15

Wing span: 60-70mm

Date of collection: 30. 06. 2007

Locality: Thankot

Status: \*\*

Habitat: Bushes and forest.

***Precis orithya* (Linnaeus, 1764)**

Common name: The Blue Pansy

Fig. 1.6

Wing span: 40-60mm

Date of collection: 12.03. 2008

Locality: Syuchatar Ward no.6

Status: \*\*

Habitat: Cultivated lands and open fields.

***Vanessa cardui* (Linnaeus, 1758)**

Common name: The Painted Lady

Fig. 1.12

Wing span: 55-60mm

Date of collection: 13. 03. 2008

Locality: Syuchatar Ward no.9

Status: \*\*

Habitat: Open fields, bushes, cultivated lands and forest.

**Papilionidae**

***Atrophaneura polyeuctes* (Doubleday, 1842)**

Common name: Common Windmill

Fig. 1.29

Wing span: 9-10cm

Date of collection: 01. 08. 2007

Locality: Godam, Thankot

Status: \*

Habitat: Forest, bushes and open fields.

***Graphium agamemnon* (Linnaeus, 1758)**

Common name: Tailed Jay

Fig. 1.30

Wing span: 8cm

Date of collection: 01. 08. 2007

Locality: Godam, Thankot

Status: \*\*

Habitat: Forest, open fields and bushes

***Graphium cloanthus* (Westwood, 1841)**

Common name: Glassy Bluebottle

Fig. 1.33

Wing span: 55-70mm

Date of collection: 26. 03. 2008

Locality: Syuchatar Ward no.8

Status: \*\*

Habitat: Open fields, bushes and forests.

***Iliades memnon* (Linnaeus, 1758)**

Common name: The Great Mormon

Fig. 1.34

Wing span: 16cm

Date of collection: 23.07. 2007

Locality: Godam, Thankot

Status: \*\*

Habitat: Forest, bushes and open fields.

***Menelaides polytes* (Linnaeus, 1758)**

Common name: The Common Mormon

Fig. 1.31

Wing span: 9cm

Date of collection: 15. 08. 2007

Locality: Godam, Thankot

Status: \*\*

Habitat: Open fields and bushes.

***Papilio Memnon* (Linnaeus, 1758)**

Common name: The Great Mormon

Fig. 1.32

Wing span: 11-12cm

Date of collection: 09. 09. 2007

Locality: Syuchatar Ward no.9

Status: \*

Habitat: Forest areas, open fields and bushes

***Papilio polyctor* (Boisduval, 1836)**

Common name: Common Peacock

Fig. 1.35

Wing span: 12cm

Date of collection: 23. 07. 2007

Locality: Syuchatar Ward no.9

Status: \*\*

Habitat: Forests, bushes and open fields.

***Troides aeacus* (Felder, 1860)**

Common name: Golden Bird wing

Fig. 1.36

Wing span: 7-8cm

Date of collection: 23.07. 2007

Locality: Godam, Thankot.

Status: \*\*

Habitat: Forest, bushes and open fields

**Danaidae**

***Danaus aglea* (Moore, 1883)**

Common name: The Glassy Tiger

Fig. 1.17

Wing span: 7cm

Date of collection: 01. 07. 2007

Locality: Godam, Thankot

Status: \*

Habitat: Cultivated lands, bushes and forest.

***Danaus chryssipus* (Linnaeus, 1758)**

Common name: The Plain Tiger

Fig. 1.11

Wing span: 8cm

Date of collection: 01. 07. 2007Menetrie

Locality: Godam, Thankot

Status: \*\*

Habitat: Bushes, cultivated lands and forests.

***Danaus genutia* (Cramer, 1779)**

Common name: Common Tiger

Fig. 1.44

Wing span: 7cm

Date of collection: 2. 03. 2008

Locality: Syuchatar Ward no.5

Status: \*\*\*

Habitat: Cultivated land, forest and bushes.

***Euploea core* (Cramer, 1780)**

Common name: Common Indian Crow

Fig. 1.39

Wing span: 75-85mm

Date of collection: 26. 03.2008



Locality: Syuchatar Ward no.8

Status: \*\*

Habitat: Open fields and bushes

***Euploea mulciber* (Cramer, 1777)**

Common name: The Striped Blue Crow

Fig. 1.18

Wing span: 9cm

Date of collection: 11. 07. 2007

Locality: Syuchatar ward no. 9

Status: \*\*

Habitat: Forest.

**Pieridae**

***Colias erate* (Esper, 1805)**

Common name: The Pale Clouded Yellow

Fig. 1.2, 1.5

Wing span: 4cm

Date of collection: 2.03. 2008

Locality: Syuchatar Ward no. 7

Status: \*\*\*

Habitat: Cultivated lands, open fields, bushes and forests.

***Colias fieldii* (Menetries, 1855)**

Common name: The Dark Clouded Yellow

Fig. 1.1

Wing span: 4cm

Date of collection: 2. 03. 2008

Locality: Syuchatar Ward no. 7

Status: \*\*

Habitat: Cultivated lands, open fields, bushes and forests.

***Eurema hecabe* (Moore, 1886)**

Common name: The Grass Yellow

Fig. 1.3

Wing span: 4-5cm

Date of collection: 2.03. 2008

Locality: Syuchatar Ward no. 7

Status: \*\*\*

Habitat: Cultivated lands, open fields, forest and bushes

.

***Gonepteryx rhamni* (Linnaeus, 1758)**

Common name: Common Brimstone

Fig. 1.38

Wing span 50-55mm

Date of collection: 30. 06. 2007

Locality: Godam, Thankot

Status: \*\*

Habitat: Cultivated lands, bushes and open fields.

***Metaporia agathon* (Gray, 1981)**

Common name: Great Black vein

Fig. 1.43

Wing span: 70-80mm

Date of collection: 3. 06. 2007

Locality: Godam, Thankot

Status: \*

Habitat: Open fields, cultivated lands, bushes and forest.

***Pieris brassicae* (Hardwickii, 1883)**

Common name: The Large Cabbage

Fig. 1.4

Wing span: 5cm

Date of collection: 2.03. 2008

Locality: Syuchatar Ward no. 7

Status: \*\*\*

Habitat: Cultivated lands, bushes and open fields.

**Lycaenidae**

***Freyeria trochilus* (Freyer, 1844)**

Common name: Grass Jewel

Fig. 1.42

Wing span: 5- 10mm

Date of collection: 26.03.08

Locality: Thankot

Status: \*\*\*

Habitat: Open fields, cultivated lands and bushes.

***Jamides alecto* (Swinhoe, 1915)**

Common name: The Metallic Cerulean

Fig. 1.27

Wing span: 3cm

Date of collection: 25. 2. 2008

Locality: Syuchatar Ward no.8

Status: \*\*\*

Habitat: Open fields, cultivated lands and bushes.

***Lampides boeticus* (Linnaeus, 1767)**

Common name: The Pea Blue

Fig. 1.28

Wing span: 4-5cm

Date of collection: 30. 06. 2007

Locality: Syuchatar ward no.8

Status: \*\*\*

Habitat: Open fields, cultivated lands and bushes.

***Zezeeria maha* (Kollar, 1848)**

Common name: The Pale Grass Blue

Fig. 1.41

Wing span: 3cm

Date of collection: 25. 02. 2008

Locality: Syuchatar Ward no.8

Status: \*\*\*

Habitat: Bushes, open fields, cultivated lands and forest.

**Satyridae**

***Mycalesis francisca* (Stoll, 1780)**

Common name: Lilacine Bushbrown

Fig. 1.23

Wing span: 3-4cm

Date of collection: 25. 02. 2008

Locality: Syuchatar Ward no.7

Habitat: Open fields and bushes.

***Melanitis leda* (Linnaeus, 1758)**

Common name: The Common Evening Brown

Fig. 1.20

Wing span: 5cm

Date of collection: 4. 09. 2007

Locality: Godam, Thankot

Status: \*\*

Habitat: Open fields, forests and bushes.

***Ypthima baldus* (Fabricius, 1775)**

Common name: The Common Five Ring

Fig. 1.22

Wing span: 2-3cm

Date of collection: 22. 06. 2007

Locality: Syuchatar ward no.8

Status: \*\*

Habitat: Bushes and open fields

***Ypthima nareda* (Kollar, 1844)**

Common name: The Large Three Ring

Fig. 1.21

Wing span: 2-3cm

Date of collection: 22. 06. 2007

Locality: Syuchatar ward no. 8

Status: \*\*

Habitat: Bushes and open fields

***Ypthima newara* (Moore, 1874)**

Common name: Newar Three ring

Fig. 1.40

Wing span: 2-3 cm

Date of collection: 22.06.2007

Locality: Godam, Thankot.

Status: \*\*

Habitat: Bushes, open fields and cultivated lands.

***Orinoma damaris* (Gray, 1846)**

Common name: Tiger Brown

Fig. 1.37

Wing span: 56-68mm

Date of collection: 26.03.08

Locality: Thankot

Status: \*\*

Habitat: Open fields, bushes and cultivated lands.

**Hesperiidae**

***Celaenorrhinus dhanada* (Moore, 1865)**

Common name: Himalayan Yellow-Banded Flat

Fig. 1.26

Wing span: 34-38mm

Date of collection: 30. 07. 2007

Locality: Syuchatar ward no.6

Status: \*\*

Habitat: Cultivated lands and bushes

***Pseudocoldenia dan* (Fabricius, 1787)**

Common name: Fulvous Pied Flat

Fig. 1.25

Wing span: 3.5cm

Date of collection: 30. 07. 2007

Locality: Syuchatar ward no.6

Status: \*\*

Habitat: Bushes and cultivated lands

### **Libytheidae**

***Libythea lepita* (Moore, 1857)**

Common name: The Common Beak

Fig. 1.7

Wing span: 4-5cm

Date of collection: 01. 07. 2007

Locality: Syuchatar ward no.6

Status \*

Habitat: Open fields and cultivated lands.

### **Acreidae**

***Pareba issoria* (Hubner, 1819)**

Common name: The Yellow Coster

Fig. 1.19

Wing span: 4cm




























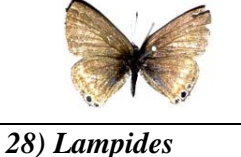
Date of collection: 19. 07. 2007

Locality: Godam, Thankot









Status: \*\*\*









Habitat: Open fields, forest and bushes.

**\*\*\* Frequency more than 20, \*\* Frequency 10 to 20, \* Frequency less than 10**

			
1) <i>Colias fieldii</i>	2) <i>Colias erate</i>	3) <i>Eurema hecabe</i>	4) <i>Pieris brassicae</i>
			
5) <i>Colias erate</i>	6) <i>Precis orithya</i>	7) <i>Libythea lepita</i>	8) <i>Précis almana</i>
			
9) <i>Neptis hylas</i>	10) <i>Phalanta</i>	11) <i>Danaus genutia</i>	12) <i>Vanessa cardui</i>
			
13) <i>Aglais</i>	14) <i>Athyma</i>	15) <i>Precis iphita</i>	16) <i>Cethosia biblis</i>
			
17) <i>Danaus aglea</i>	18) <i>Euploea</i>	19) <i>Pareba issoria</i>	20) <i>Melanitis leda</i>
			
21) <i>Ypthima nareda</i>	22) <i>Ypthima baldus</i>	23) <i>Mycalesis</i>	24) <i>Precis hierta</i>
			
25) <i>Pseudocoladenia</i>	26) <i>Celaenorrhinus</i>	27) <i>Jamides alecto</i>	28) <i>Lampides</i>

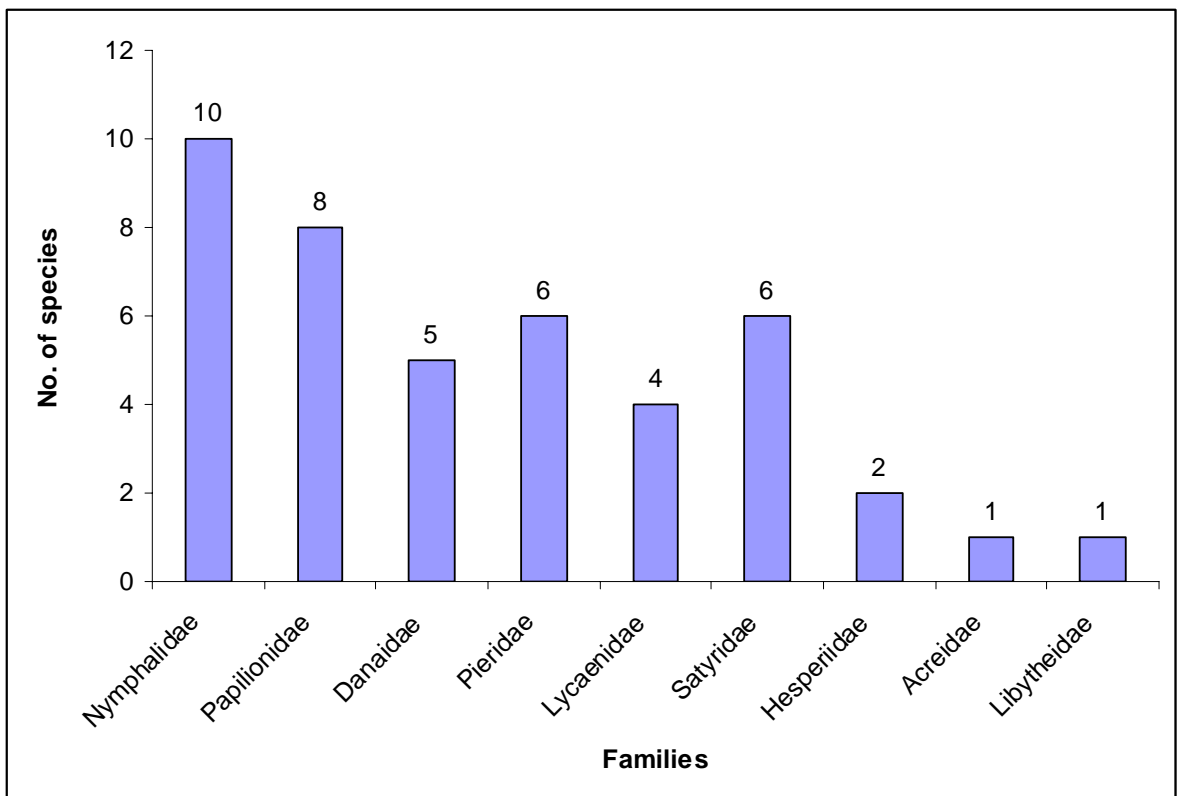


	
<p>29) <i>Atrophaneura polyeuctes</i></p>	<p>30) <i>Graphium agamemnon</i></p>
	
<p>31) <i>Menelaides polytes</i></p>	<p>32) <i>Papilio memnon</i></p>
	
<p>33) <i>Graphium cloanthus</i></p>	<p>34) <i>Iliades memnon</i></p>
	
<p>35) <i>Papilio polyctor</i></p>	<p>36) <i>Troides aeacus</i></p>

			
<i>37) Orinoma</i>	<i>38) Gonepteryx</i>	<i>39) Euploea core</i>	<i>40) Ypthima newara</i>
			
<i>41) Zezeeria maha</i>	<i>42) Freyeria</i>	<i>43) Metaporia</i>	<i>44) Danaus genutia</i>

## 4.2 Diversity of butterflies

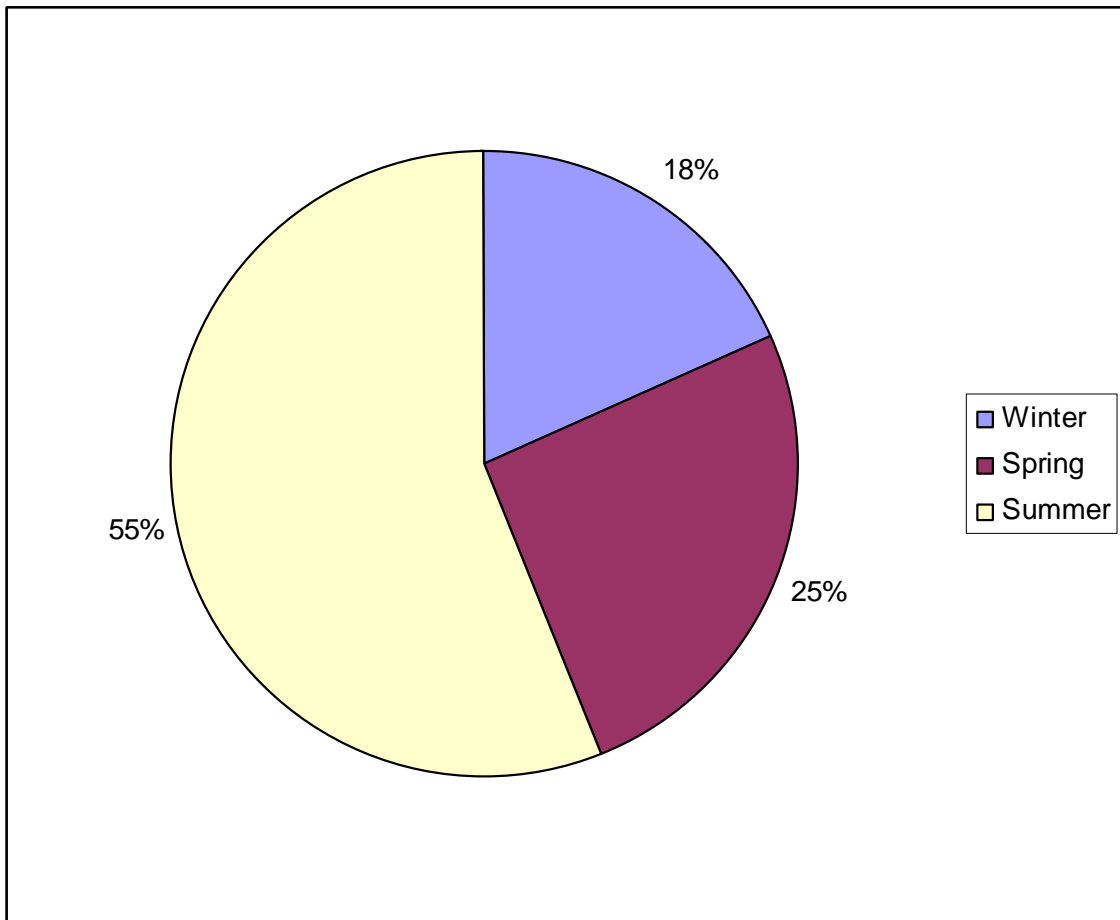
Altogether 43 species of butterflies belonging to 32 genera and 9 families were recorded from both the study area. The family with the highest number of species was Nymphalidae with a total number of 10 species and the families with the least number of species were Acreidae and Libytheidae with 1 species each.



**Fig. 2** Composition of recorded species by families from both study sites

### 4.3 Seasonal Variation

Butterflies were collected in three different seasons Summer, Winter and Spring. Most of the species were collected during Summer season. Out of forty three 8 (18%) were collected during Winter. 11 species (25%) were collected during Spring season and 24 species (55%) were collected during Summer season which. These results are represented in Fig. 2



**Fig. 3 Seasonal composition of recorded species in percentage.**

#### 4.4 Habitats of butterflies

Butterflies were collected from different habitats such as open fields (OF), cultivated lands (CL), bushes (B) and forests (F).

Table No. 1 Habitats of butterflies

Family	S.N	Syuchatar Genus species	Habitats			
			OF	CL	B	F
Nymphalidae	1	<i>Aglais cashmirensis</i>	+	+	+	+
	2	<i>Athyma selenophora</i>	-	-	+	+
	3	<i>Cethosia biblis</i>	-	-	+	+
	4	<i>Phalanta phalanta</i>	+	+	+	-
	5	<i>Precis almana</i>	-	-	+	+
	6	<i>Precis hierta</i>	+	+	+	-
	7	<i>Precis iphita</i>	-	-	+	+
	8	<i>Precis orithya</i>	+	+	-	-
	9	<i>Neptis hylas</i>	+	+	+	+
	10	<i>Vanessa cardui</i>	+	+	+	+
Papilionidae	11	<i>Atrophaneura polyeuctes</i>	+	-	+	+
	12	<i>Graphium agamemnon</i>	+	-	+	+
	13	<i>Graphium cloanthus</i>	+	-	+	+
	14	<i>Iliades memnon</i>	+	-	+	+
	15	<i>Menelaides polytes</i>	+	-	+	+
	16	<i>Papilio memnon</i>	+	-	+	+
	17	<i>Papilio polyctor</i>	+	-	+	+
	18	<i>Troides aeacus</i>	+	-	+	+

Danaidae	19	<i>Danaus aglea</i>	-	+	+	+
	20	<i>Danaus chryssipus</i>	-	+	+	+
	21	<i>Danaus genutia</i>	+	-	+	+
	22	<i>Euploea core</i>	+	-	+	-
	23	<i>Euploea mulciber</i>	-	-	-	+
Pieridae	24	<i>Colias erate</i>	+	+	+	+
	25	<i>Colias fieldii</i>	+	+	+	+
	26	<i>Eurema hecabe</i>	+	+	+	+
	27	<i>Gonepteryx rhamni</i>	+	+	+	-
	28	<i>Metaporia agathon</i>	+	+	+	+
	29	<i>Pieris brassicae</i>	+	+	+	-
Lycaenidae	30	<i>Freyeria trochilus</i>	+	+	+	-
	31	<i>Jamides alecto</i>	+	+	+	-
	32	<i>Lampides boeticus</i>	+	+	+	-
	33	<i>Zezeeria maha</i>	+	+	+	+
Satyridae	34	<i>Mycalesis francisca</i>	+	-	+	-
	35	<i>Melanitis leda</i>	+	-	+	+
	36	<i>Ypthima baldus</i>	+	-	+	-
	37	<i>Ypthima nareda</i>	+	-	+	-
	38	<i>Ypthima newara</i>	+	+	+	-
	39	<i>Orinoma damaris</i>	+	+	+	-
Hesperiidae	40	<i>Celaenorrhinus dhanada</i>	-	+	+	-
	41	<i>Pseudocoladenia dan</i>	-	+	+	-
Libytheidae	42	<i>Libythea lepita</i>	+	+	-	-
	43	<i>Pareba issoria</i>	+	-	+	+

(+) sign indicates presence and (-) sign indicates absence of specimens

Among the four habitats, most of the species were found in bushes and forest.

Species like *Neptis hylas*, *Vanessa cardui*, *Colias erate*, *Colias fieldii*, *Eurema hecabe* and *Zezeeria maha* were found in all the four habitats.

## 4.5 Colour Variation

Butterflies showed colour variation in different seasons (Spring, Summer and Winter). Some species bear a very different appearance at different seasons of the year and therefore producing two forms of the same species differing in colour, markings and spots.

**Table No.2 Color variation of some butterflies**

Family	S.N	Name of Species	Seasons		
			Spring	Summer	Winter
Nymphalidae	1.	<i>Precis iphita</i>	Light brown without bands	Dark brown with dark bands	Dark brown with dark bands
	2.	<i>Ypthima baldus</i>	Light brown with faded rings	Dark brown with dark visible rings	Dark brown with dark visible rings
Satyridae	3	<i>Ypthima nareda</i>	Light brown without brown bands	Dark brown with brown bands at the margin	Dark brown with brown bands at the margin

Of 43 species, only 3 species namely *Ypthima baldus*, *Precis iphita* and *Ypthima nareda* belonging to 2 families (Nymphalidae and Satyridae) showed colour variation in three different seasons.



#### 4.6 Discussion

Altogether 43 species were collected from both the sites with Nymphalidae (23.2%), Papilionidae (18%), Danaidae (11%), Pieridae (13.9%), Lycaenidae (9.3%), Satyridae (13.9%), Hesperidae (4.6%), Acreidae (2.3%) and Libytheidae (2.3%). Studying the seasonal occurrence of butterflies showed that 18% were found in winter, 25% in spring and 55% in summer. This result interprets that diversity is higher in Summer than in Spring and least in Winter. The species *Aglais cashmirensis* was observed throughout the year and some other species like *Precis iphita*, *Colias erate*, *Eurema hecabe*, *Pieris brassicae*, *Lampides boeticus* and *Melanitis leda* were found in all the three seasons.

Butterflies were collected from different habitats like open field, cultivated land, bushes and forest. Comparing both the sites, most of the species were found in bushes. Species like *Pieris brassicae*, *Lampides boeticus*, *Melanitis leda* were collected from cultivated land (vegetables). This is because the larvae of these species feed on vegetables like cabbage and cauliflower. Species like *Lampides boeticus*, *Jamides alecto*, *Pareba issoria* were found in bushes whereas *Papilio memnon*, *Atrophaneura polyeuctes*, *Graphium agamemnon* inhabited forests and open fields. *Precis iphita* and *Precis orithya* were collected from both bushes and open fields. *Aglais cashmirensis*, *Vanessa cardui*, *Neptis hylas*, *Colias erate*, *Colias fieldii*, *Eurema hecabe*, *Metaporia agathan* and *Zezeeria maha* were common in all the four habitats.

Of forty three species, 25 belonging to 20 genera and 8 families were collected from Site 1 (Syuchatar) and 18 belonging to 17 genera and 7 families were collected from Site 2 (Thankot). The family Nymphalidae was recorded to have the highest number of species whereas Libytheidae and Acreidae the least with one species each. Species like *Pieris brassicae*, *Colias erate*, *Colias fieldii*, *Neptis hylas*, *Vanessa cardui* and *Aglais cashmirensis* were very common.

Except Acreidae and Libytheidae all the other families were common in both the sites (Thankot and Syuchatar). Acreidae was found only in site 2(Thankot) with no traces in site 1(Syuchatar) and Libytheidae was found only in site 1(Syuchatar) with no traces in site 2(Thankot).This result has been obtained probably due to destruction of habitats.

Colour variation was observed among some species in different seasons. One single species showed two forms due to colour differences in different seasons like summer, spring and winter. Three species namely *Ypthima baldus*, *Precis iphita* and *Ypthima nareda* showed colour variation. *Ypthima baldus* appeared light brown with faded rings in spring whereas in summer it appeared dark brown with dark visible rings. *Precis iphita* showed light brown colour without any visible bands in spring but in summer it changed into dark brown with brown bands. *Ypthima nareda* appeared light brown colored without bands in spring and in summer as dark brown colored with brown bands.

Among all the species of butterflies from Thankot and Syuchatar, *Troides aeacus* (Papilionidae), The golden bird wing was the largest one with the wing span of 16 cm. This species was recorded from Thankot and is under the protected lists CITES (Appendix II). *Freyeria trochilus* was the smallest butterfly with the wing span of 10-15mm. *Ypthima newara* and *Metaporis agathan* recorded from Thankot were also observed by Smith and reported as the endemic butterflies of Nepal in 1993.

Overall results are almost similar to the results that were obtained by Ghimire (2001) from Champadevi, Kirtipur, Kathmandu. He reported 9 families with the maximum species diversity from the family Nymphalidae. He also reported the species *Troides aeacus* which is under the protected lists CITES (APPENDIX II). Smith also obtained similar results from eastern Nepal. He

recorded 6 families with the maximum species diversity from the family Nymphalidae. A very similar result was observed by Bhusal (2001) in Eastern Siwalik range of Nepal with the family Nymphalidae having the highest number of species richness.

#### **4.7 CONCLUSION**

This study concludes that Nymphalidae (23.2%) is the predominant family and Acreidae (2.3%) and Libytheidae (2.3%) are among the rare families. This study also shows that the most preferred habitats of the collected species are the bushes, forest and opens fields. Summer recorded the highest number of species than Spring and Winter which attribute to the availability of more food due to flowering season of both cultivated and wild plant species. Both the sites are biodiversity rich areas. Although Thankot is surrounded by Public Park and schools yet it harbors protected species like *Troides aeacus* because still most of the areas are covered with forests and suitable habitats for these species. But the process of urbanization leading to deforestation and destruction of habitats cannot be ignored which have started making their mark in these areas.

## **4.8 Recommendations**

During this study it was observed that although the research sites are covered with forests and most of the land area has been used for cultivation of different crops, urbanization and deforestation is increasing day by day thereby creating threat to the existing species.

Following points have been recommended for the protection of butterflies:

- 1) The inhabitants should be made aware of economic as well as aesthetic values of butterflies.
- 2) Deforestation and urbanization should be kept under check preserving their natural habitat.
- 3) Hotspots of butterfly habitats should be declared at policy level for further conservation.
- 4) More studies are needed on conservation and ecology of butterflies.



**Deforestation and destruction of habitats**



**Land used for cultivation of crops**

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## Appendix II

### Average rainfall (mm) of Kathmandu district (1997-2006)

Year	Months											
	January	February	March	April	May	June	July	August	September	October	November	December
<b>1997</b>	17.3	3.2	15.9	101.3	70.9	292.5	427.5	377.3	149.4	3.3	6.2	62.6
<b>1998</b>	0.0	24.3	110.1	48.7	257.2	228.8	394.5	455.9	90.9	26.9	1.6	0.0
<b>1999</b>	6.4	11.4	0.0	0.0	90.6	327.2	427.3	386.2	229.1	185.1	0.0	0.0
<b>2000</b>	0.0	0.0	10.0	54.8	174.0	298.7	336.2	551.7	149.6	0.0	0.0	0.0
<b>2001</b>	0.0	0.0	6.7	49.8	179.8	286.0	527.4	411.5	161.6	20.0	0.0	0.0
<b>2002</b>	0.0	31.4	60.7	68.3	205.9	223.4	604.9	438.1	251.1	0.0	12.7	0.0
<b>2003</b>	16.5	46.0	22.0	54.6	18.9	274.2	706.8	454.7	396.4	16.4	0.0	20.8
<b>2004</b>	15.2	0.0	0.0	122.7	186.1	66.8	355.8	199.1	214.5	108.2	30.1	0.0
<b>2005</b>	49.0	12.1	70.9	37.1	73.9	262.8	305.7	295.7	154.5	94.9	0.0	0.0
<b>2006</b>	0.0	0.0	22.5	129.8	165.7	190.6	394.8	441.1	275.2	20.4	0.0	23.1
<b>TOTAL</b>	104.4	128.4	318.8	667.1	1423	2451	4480.9	4011.3	2072.3	475.2	50.6	106.5
<b>MEAN</b>	10.44	12.84	31.88	66.71	142.3	245.1	448.09	401.13	207.23	47.52	5.06	10.65

**Source: Meteorological Department, Babar Mahal, Kathmandu.**

## Appendix I

**Average means of maximum and minimum temperatures (°C) of Kathmandu district (1997-2006)**

Year	Months											
	January	February	March	April	May	June	July	August	September	October	November	December
<b>1997</b>	9.75	11.2	15.25	17	20.8	24.4	25.05	25	23.8	17.5	15.1	10.35
<b>1998</b>	9.1	12.6	15	18.7	22.75	24.9	24.35	23.95	23.95	21.2	15.9	12.1
<b>1999</b>	10.6	15	17.55	21.8	23.2	24.05	23.8	25.75	23.5	20.85	15.7	12.85
<b>2000</b>	10.4	11.05	15.2	20.35	22.5	24.3	24.4	24.35	23.1	20.55	16.55	12.4
<b>2001</b>	11.1	12.85	16.15	19.8	21.8	23.8	24.55	24.15	23.45	21.1	16.9	11.8
<b>2002</b>	10.4	12.9	17.35	19.45	21.75	24.15	24.4	24.25	22.75	20.1	15.85	12.05
<b>2003</b>	9.65	12.45	15.9	20.65	21.5	24.35	24.45	24.45	23.45	20.5	16.25	12.1
<b>2004</b>	10.45	13	19	20.4	23.15	23.55	23.65	24.45	23.6	19.6	15.55	12.7
<b>2005</b>	11.2	13	17.6	19.75	21.85	24.85	24.75	24.5	24.3	20.7	15.5	12.85
<b>2006</b>	11.55	15.85	17.35	19.45	22.4	24.8	24.9	24.65	23.55	21.3	16.15	14
<b>TOTAL</b>	104	129.9	166.35	197.35	221.7	243.15	244.3	245.5	235.45	203.41	59.45	123.2
<b>MEAN</b>	10.42	12.99	16.63	19.73	22.17	24.31	24.43	24.55	23.54	20.34	15.94	12.32

**Source: Meteorological Department, Babar Mahal, Kathmandu.**