

Nanda Devi Expedition - 2001

Report



By
Dr. V.P. Uniyal



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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1. Introduction

Nanda Devi National Park is located within the high mountainous ranges of Garhwal Himalayas in the upper catchment of the river Alakananda, the eastern tributary of the river Ganga. The Nanda Devi is the second highest peak (7,817m) in India and considered the world's second toughest peak to climb. Several mountaineering expeditions have been conducted to climb the Nanda Devi but few of them could succeed due to tough terrain. The mountain basin of Nanda Devi falls within the jurisdiction of Chamoli district and its eastern and southern boundaries falls in Bageshwar and Pithoragarh districts of Uttaranchal state respectively. In 1883, W.W. Graham made first attempt to enter in the valley but could reach only upto outer sanctuary. Several people made attempts to visit the Nanda Devi but failed to see the entire valley. Longstaff was the first person who has sighted the north sanctuary area of Nanda Devi and climbed the Trishul Peak. In 1934, Eric Shipton and Bill Tilman were the first mountaineers who entered in the Nanda Devi valley.

Nanda Devi is one of the important site of wilderness and hot spot of biodiversity in the Himalayan region. The importance of this area came under fame when the entire basin was declared as sanctuary in 1939. Subsequently, various activities *viz.* trekking, mountaineering, biological surveys and expeditions started in this fragile ecosystem and there was no curb on human pressure. Realizing ill effects of human pressure, the entire area was declared as the Nanda Devi National Park (NDNP) in 1982. Further, in January 1988 the area was notified as the second Biosphere Reserve of India and designated as the Nanda Devi Biosphere Reserve (NDBR). The NDBR was the second such reserve in India to be established under the Man and Biosphere Programme (MAB) launched by the UNESCO in 1970. Realising the importance of its biological diversity and occurrence of several rare and endangered floral and faunal species the NDBR was listed as **World Heritage Site** in December 1988.

Later the area of NDBR was enlarged by Government notification in February 2000. The enlarged area of NDBR includes the Nanda Devi National Park and Valley of Flowers National Park (Fig. 1). The total area of present NDBR is 5860.69 sq km with 712.12 sq km core area comprising both the national parks (Negi, 2002). The NDBR is located at Latitude N30°08' - 31° 02' and Longitude E 79° 12' - 80° 19' with large altitudinal range 1,800 to 7,817 amsl with unique topography, climate and soil supporting diverse ecosystem, habitats, communities, richness and species. The high

percentages of endemic species richness itself identify the conservation value of the reserve. The reserve supports over 1,000 species of plants including bryophytes, fungi and lichens and about 520 species of fauna including mammals, birds, reptiles, amphibians, fishes, insects and molluscs and annelids (Samant, 2001). A total of 45 villages falls within the buffer zone of the reserve. The inhabitants belong to the Indo-Mongoloid (Bhotia) and Indo-Aryan groups.

Since the past three decades many naturalists, wildlifers, researchers from various research institutions and universities attempted to study the biodiversity of the reserve. Most of them have conducted the studies only in the buffer zone of the reserve. The studies mainly carried out by: Kumaun University, Nainital; Garhwal University Srinagar; G.B. Pant Institute of Himalayan Environment & Development, Almora; Wildlife Institute of India (WII); Indian Institute of Remote Sensing (IIRS), Dehra Dun; High Altitude Plant Physiology Research Centre (HAPRC), Srinagar; Zoological Survey of India (ZSI); Botanical Survey of India (BSI) and Forest Research Institute (FRI). Dang (1961) and Khachar (1978) visited the park and describe the uniqueness and diversity of the area. The initial faunal surveys of the Nanda Devi National Park were mainly conducted by team of scientists from ZSI, Dehra Dun (Lamba 1985, 1987, Tak and Kumar 1983 a & b, Tak and Lamba 1984, 1985, Tak 1986 and Arora et al. 1995). Subsequently ZSI and other institutions again conducted the faunal studies in the buffer area of NDBR (Kumar 1997, Khanna 1997, Ghosh 1997, Hajra 1997 and Mazumdar 1997 and Joshi et al. 2000).

Hajra (1983), Samant (1993) and Hajra and Balodi (1995) studied the floral diversity of this area, later as large number of scientists from different research organizations and universities studied floral diversity in the buffer zone of the NDBR. Upreti and Negi (1995) described lichens; Maikhuri et al. (1998) have been working on ethnobotanical aspects; Kala et al. (1998) exclusively studied the ecology and conservation of the Valley of Flowers National Park; Silori et al. (1999) conducted socioeconomic studies for sustainable development; Sahi and Kimothi (1996) conducted mapping and monitoring studies using remote sensing techniques and Mohan (1992) and Kumar (1998) have suggested the management issues for the NDBR.

In 1993, a scientific and ecological expedition in Nanda Devi National Park was conducted by Corp of Engineers with scientists and experts from different

organizations viz. S. Sathyakumar (WII); R. Sankaran (SACON); Cap. A. Baindur (Corp of Engineers); Ajay Rastogi (WWF); S. S. Samant (G.B. Pant Institute) and B. Balodi (BSI). These experts have documented 14 species of mammals, 80 species of birds, 620 species of plants, 28 species of butterflies, and analyzed the water quality of Rishi Ganga (core area) as well as drinking water quality of buffer zone.

The Garhwal Rifles Regiment Centre, Lansdowne conducted the expedition in Nanda Devi in September 2001 and named this expedition as **Clean Nanda Devi Expedition 2001**. The author got an opportunity to join this expedition from 26 August to 14 September, 2001 and thus studied the faunal and floraal diversity of the park. Following objectives were undertaken during the expedition.

2. Objectives

- Status survey of mammals.
- Status survey of butterfly.
- Status of prominent medicinal plants.
- Biotic pressure in term of grazing, herb collection and tourist etc

3. Study Duration and Expedition Route

The expedition team (20 Army personnel, 4 park staff, one scientist and 20 porters) started the journey from Joshimath after certain preparation and reconnaissance around Joshimath. The expedition route was from Lata, Lata Kharak, Dharansi, Dibrugetha, Deodi, Ramni, Bhujgarh, Patalkhan, Sarsopatal and Nanda Devi base camp (Fig.2). The Rishi Ganga is the main river flows in the park originates from the Nanda Devi glacier. After crossing the Rishi Ganga in Deodi one can reach up to the base camp, north sanctuary and other area of the park. Details of stay and locations are given in the Table 1.

Table 1. Survey routes and duration of stay in Nanda Devi National Park

Date	Expedition Route
26.8.2001	Dehra Dun to Joshimath
27 to 30. 8.2001	Visited Rani, Lata and Tolma villages.
31.8.2001	Joshimath to Lata
1.9.2001	Lata to Lata Kharak
2. & 3. 9.2001	Lata Kharak and Saini Kharak
4.9.2001	Lata Kharak to Dharansi
5.9.2001	Dharansi to Dibrugheta
6.9.2001	Dibrugheta to Deodi
7.9.2001	Deodi to Ramni
8.9.2001	Ramni to Bhujgarh
9.9.2001	Bhujgarh to Sarsopatal
10 to 13.9.2001	Sarsopatal, Devastan base camp, North Sanctuary and Nanda Devi base camp.
14.9.2001	Sarsopatal to Joshimath

3.1 Location of Camping Sites

Joshimath (N30°33'17.7" E79°33'17.5", 2,050 amsl): Office of the Deputy Director of Nanda Devi National Park is located at Joshimath. All necessary permission and support for the visitors provided by the Dy. Director of the park. Preparation for this expedition, interaction with the staff and relevant information were collected from park officials.

Lata village (N30°29'47" E79°42'33", 2,100 amsl): The trek started from Lata village, which is located on the bank of river Dhauri Ganga on the way to Malari and Niti Pass (Fig.2). The village is surrounded by cultivated land and mixed broad-leaved forest. The first wildlife sighting started with goral and Himalayan tahr from here. A Chukor partridge was sighted on the village fringe. Large number of butterflies viz. Large cabbage white, Indian cabbage white, Bath white, Great blackvein and Himalayan blackvein of family Pieridae were recorded from the agriculture fields. Family Pieridae and Nymphalidae were also recorded on the way to Akhori Belta and Belta Kharak which was surrounded by broad leaved forests and grassy patches.

Lata Kharak (N30°29'49" E79°45'04", 3,800 amsl): Lata Kharak is located within the sub alpine forest area dominated by deciduous and evergreen forests. The dominant plant species in the Lata and Saini Kharak area were: *Acer acuminatum*,

Prunus cornuta, *Salix disperma*, *Populus ciliata* and *Sorbus foliolosa*, *Abies pindrow*, *A. spectabilis*, *Pinus wallichiana*, *Taxus baccata* and *Betula utilis*. Shrub species of *Ribes* sp., *Sarcococca* sp., *Salix* sp., *Desmodium* sp., *Viburnum* sp., *Rosa* sp., *Lonicera* sp., *Rhododendron campanulatum*, *R. anthopogon*, *R. lepidotum*, *Cotoneaster affine*, *Berberis aristata* and *Inula cuspidata* were seen here. The dominant flowering herbaceous plants found were: *Jurinea dolomiaea*, *Polygonum amplexicaulis*, *Aconitum heterophyllum*, *Ligularia sibirica*, *Dactylorhiza hatagirea*, *Potentilla* sp., *Morina coulteriana*, *Delphinium* sp., *Meconopsis aculeata*, *Arnebia benthamii*, *Picrorhiza kurrooa*, *Aster* sp. *Aquilegia* sp. *Pedicularis* sp. *Geranium* sp. and *Anemone* sp. The butterfly species observed within the flowering community in Lata and Saini Kharak area were Yellow swallowtail (*Papilio machaon*), Common blue apollo (*Parnassius hardwicki*), Indian tortoiseshell (*Aglaia cashmirensis*), Dark clouded yellow (*Colias fieldii*), Queen of Spain fritillary (*Issoria lathonia issaea*) and Indian red admiral (*Vanessa indica*). One indirect sighting of leopard and more than 20 pika were recorded around the Lata Kharak area.

Dharansi Pass (N30°28'48" E79°47'45", 4,200 amsl): After steep climbing through several cliffs and narrow gorges we could reach Dharansi pass. This trek is known as *Sath Khol* (passing through seven cliffs). The entire trek gone through alpine pasture dominated by herbaceous plant community. The dominant plant species were *Jurinea dolomiaea*, *Aconitum violaceum*, *Ligularia sibirica*, *Podophyllum hexandrum*, *Dactylorhiza hatagirea*, *Meconopsis aculeata*, *Arnebia benthamii* and *Picrorhiza kurrooa* etc. The prominent butterfly species were yellow swallowtail, Common blue apollo and Dark clouded yellow. Sightings of bharal, Himalayan weasel, snow pigeon, snow partridge and Himalayan griffon vulture was documented in the Dharansi area.

Dibrugheta (N30°27'35" E79°47'57", 3,500 amsl): Dibrugheta, the large meadow surrounded by thick patches of *Betula*, *Rhododendron*, *Abies* and *Taxus baccata*. The dominant medicinal plants recorded near the camping site were: *Allium* sp., *Aconitum violaceum* and *Podophyllum hexandrum*. Above the camping site on the way to Pharkun Dhar one musk deer was sighted.

Deodi (N30°26'17" E79°49'07", 3,600 amsl): Deodi camping site was situated near the Rishi Ganga surrounded by thick patches of *Betula utilis*. The camp site was covered by large number caves. A rope bridge was established near Deodi to cross the

Rishi Ganga so that we could reach up to the Nanda Devi base camp and other area of the park. The prominent medicinal plants were recorded on the way were: *Aconitum falconeri*, *Angelica glauca*, *Picrorhiza kurroa* and *Podophyllum hexandrum*.

Ramni (N30°25'35" E79°50'59", 3,600 amsl): Ramni was situated on the bank of Rishi Ganga and surrounded by thick *Betula* patches. *Arnebia benthamii* and *Angelica glauca* were recorded as the dominant medicinal plants of this area. A total of 20 pika were observed near the campsite.

Bhujgarh (N30°25'18" E79°51'46", 4,000 amsl) : Bhujgarh was located in the alpine pasture mainly dominated by *Rhododendron anthopogon* and few patches of *Betula utilis*. Musk deer pellets were observed on the way to Bhujgarh camp. Around 10 blue sheep were sighted on the cliffs of Pataalkhan. The toughest climb of the expedition was at Pataalkhan known as *Baikhuntsidi*, which was crossed by the team to reach Sarsopatal.

Sarsopatal (N30°23'01" E79°55'30" 4,300 amsl) : The last camping site of the expedition was the Sarsopatal, a large alpine pasture on the base of Nanda Devi Mountain. It was observed as an ideal habitat for blue sheep, snow cock, butterflies and several species of medicinal plants. A total of 56 blue sheep, eight snowcock, one golden eagle, four lammergeier, and about 30 snow pigeon were recorded in different locations of Sarsopatal area.

4. Results

4.1 Faunal Diversity

4.1.1 Mammals

During the survey, seven mammalian species were sighted and three more species were confirmed based on indirect evidences (Table 2). The Goral (*Naemorhaedus goral*), Himalayan tahr (*Hemitrahus jemhalicus*), Himalayan musk deer (*Moschus chrysogaster*), blue sheep (*Psuedois nayaur*), red fox (*Vulpus vulpus*), Himalayan weasel (*Mustela sibirica*) and pika (*Ochotonar royeli*) were sighted in different locations. Presence of snow leopard (*Panthera unica*), black bear (*Selenarctos thibetana*) and common leopard (*Panthera pardus*) were confirmed by evidences of their scat. The sighting result of the mammals surveys are presented as below.

Goral (*Naemorhaedus goral*)

Two goral were sighted near the Lata village. The area is outside the National Park but within the biosphere reserve. No other sighting of goral was recorded from the park area. Sathyakumar, (1993) and Arora et al. (1995) also reported the presence of goral in the same area.

Himalayan Tahr (*Hemitrahus jemhalicus*)

Fifteen individuals of Himalayan tahr were sighted in two different locations. Eleven individuals were observed near Lata village and four below Sani Kharak (3,800m) area. The Sani Kharak and beyond Dharansi areas could be an ideal habitat for Himalayan tahr.

Black Bear (*Selenarctos thibetanus*)

Two indirect sightings of black bear (confirmed through scat) were observed near Akhori Belta (above Lata village, 2,200m). No direct sightings of black bear were recorded so far by any survey team because of its nocturnal habit, but records of indirect sightings with plenty of footprints and scat were recorded in different areas of the park.

Common Leopard (*Panthera pardus*)

Only on two occasions leopard pug marks and scat were recorded near Akhori Belta (2,200m) and Sani Kharak (3,800m) area. So far no records of direct sighting were documented by any survey team.

Snow Leopard (*Panthera unica*)

A total of 3 indirect records of this highly endangered elusive cat were observed through fresh pugmarks in Malla Dharansi (4,400m) and Pataalkhan (4,300m) area and scat was collected above Sarsopatal (4,300m). There was no record of direct encounter of snow leopard by earlier survey teams in the park area.

Himalayan Musk Deer (*Moschus chrysogaster*)

An endangered and state animal of Uttaranchal, the Himalayan musk deer was sighted (one individual) in Parkhun Dhar (3,792m) and fresh pellets scat was recorded on the way to Bhujgarh (4,067m) above Ramni. The ideal habitat for musk deer was observed near Dibrugheta meadow (3,500m). Arora, et al. (1995) recorded 6 musk deer in Dibrugheta, Deodi and Ramni area and Sathyakumar (1993) sighted 28

individuals in Dibrugheta and Bithartoli area. During the present survey there was a constant disturbance in this area due to large number of team members in the expedition. It seems to be the cause of less number of sightings in this ideal habitat of musk deer.

Bharal or Blue Sheep (*Psuedois nayaur*)

An endangered but one of the most sighted ungulate encountered in many places during the survey. Total 245 individuals were sighted in 10 different groups. Eighty blue sheep was sighted in different locations in Dharansi, Malla Dharansi and near Hanuman Peak (4,200 to 4,400m). Most of the sighting was occurred in Pataalkhan, North Sanctuary, Sarsopatal, Malla Sarsopatal, Devastan and Nanda Devi base camp area (4,300 to 4,500m). Sarsopatal was observed as an ideal habitat for blue sheep. The group size of blue sheep was observed between 10 to 55 in a sight. No kill was encountered during the survey.

Red Fox (*Vulpus vulpus*)

One direct sighting of Red fox was recorded in Malla Dharansi (4,300m). No other encounter was observed during the survey.

Himalayan Weasel (*Mustela sibirica*)

Two Himalayan weasels were sighted in Dharansi Pass (4,300m) near the camp.

Pika (*Ochotona roylei*)

The Royle's Pika was one of the common species occurred in the park. A total of 55 individuals were sighted near camping areas of Lata Kharak, Dharansi and Ramni (3,600 to 4,200m).

Common Langur (*Presbytis entellus*)

A total of 60 individuals were sighted in three different locations. The troop size was between 20 and 25 individuals. One sighting was in the buffer zone near Belta Kharak (2,700m) and two sightings in the core zone of the park such as Dibrugheta (3,500m) and Deodi (3,600m).

4.1.2 Galliformes Status

Sankaran (1993) recorded a total 141 bird species from NDBR of which 57 species within the National Park. Arora, et al. (1995) recorded 175 bird species belonging to

95 genera and 37 families from the buffer and core area of the NDBR. Sankaran (1993) also gave a distribution of bird species among different habitat types. The Himalayan region is known for 13 species of pheasant, 10 partridge and at least 3 species of quail (Sankaran, 1993). During the present survey the most prominent pheasants, partridge and raptors species were recorded (Table 3). Details are given below:

Himalayan Monal (*Lophophorus impejanus*)

The state bird of Uttaranchal (Himalayan monal) was sighted near Lata Kharak and Saini Kharak area. Totally four individuals (male only) were sighted during the survey and a number of calls were recorded in Lata Kharak and Dibrugetha. Tak and Kumar (1987) recorded 63 individuals between 1981 and 1984 staying 167 days in the National Park. Lamba (1987) recorded 121 sightings within 35 days and Sankaran (1993) recorded about 121 (including calls).

Koklas Pheasant (*Pucrasia macrolopha*)

One pair of Koklas was sighted in the forested area above Dibrugetha. This was the only sighting during the survey. Only few calls were recorded on the way to Deodi by the forest staff.

Snow Partridge (*Lerwa lerwa*)

One individual was sighted before Dharansi Pass just crossing after Sathkhool at 5.30 pm. There was no other sighting or calls recorded during the survey. Sankaran (1993) also documented one sighting and few calls of Snow partridge in the same area.

Chukor Partridge (*Alectoris chukar*)

Sighting of ten individuals and many calls were recorded near Lata village in the agriculture fields. There were also records of Chukor in the buffer zone of the reserve.

Himalayan Snowcock (*Tetraogallus himalayensis*)

Eight snowcock were sighted in four different location of Sarsopatal. Several calls also recorded early morning near the camp site and large numbers of feathers were also observed in this area.

Snow Pigeon (*Columba leuconota*)

Total 60 snow pigeon in 10 different groups were sighted in different areas *such as*

Dharansi, Patalkhan and Sarsopatal. Once they were flushed at Sarsopatal and flew across the river and landed on rocky cliffs of the Nanda Devi Mountain.

Himalayan Golden Eagle (*Aquila chrysaetos*)

Only one individual of Golden eagle was sighted in Sarsopatal area. Sankaran (1993) documented calls and sighting of golden eagle from the same area and above Trisul Nallah.

Himalayan Griffon (*Gyps himalayensis*)

On the way from Lata Kharak to Dharansi three Himalayan griffon were sighted. No other record was documented from other areas.

Lammergeier (*Gypaetus barbatus*)

Four individuals of Lammergeier were sighted in Sarsopatal area. Sankaran (1993) recorded very frequent sighting of Lammergeier in Dibrugheta to Sarsopatal trek.

**Table 2 - Sighting details of mammals in Nanda Devi National Park
(1 to 14 September 2001)**

Species	Location	Altitude (m)	No. of Sightings		Total Individuals	Remarks
			Direct	Indirect		
Goral <i>Naemorhaedus goral</i>	Lata village	2,100	1		2	
Himalayan tahr <i>Hemitrahus jemhalicus</i>	Lata village	2,100	1		11	
	Saini Kharak	3,800	1		4	
Black Bear <i>Selenarctos thibetanus</i>	Akhori Belta	2,200	-	2	-	Scat
Common leopard <i>Panthera pardus</i>	Akhori Belta	2,200	-	4	-	Pugmarks & scat
	Saini Kharak	3,800	-	1	-	Scat
Himalayan Musk deer <i>Moschus chrysogaster</i>	Parkhun Dhar	3,700	1		1	
	Bhujgarh	4,000	-	1	-	Pellet
Blue sheep <i>Psuedois nayaur</i>	Dharasi Pass, Malla Dharasi and near Hanuman peak	4,500	2		80	
	Patalkhan	4,300	1	-	10	
	North Sanctuary	4,300	2	-	24	
	Sarsopatal	4,300	1	-	36	
	Malla Sarsopatal	4,400	1	-	20	
	Devastan base camp area	4,500	1	-	55	
	Nanda Devi base camp area	4,300	2	-	20	
Snow leopard <i>Panthera unica</i>	Malla Dharansi	4,500	-	1	-	Pugmarks
	Patalkhan	4,300	-	1	-	Pugmarks
	Sarsopatal	4,300	-	1	-	Scat
Red Fox <i>Vulpus vulpus</i>	Malla Dharansi	4,500	1	-	1	

Species	Location	Altitude (m)	No. of Sightings		Total Individuals	Remarks
			Direct	Indirect		
Himalayan Weasel <i>Mustela sibirica</i>	Dharansi Pass	4,300	1	-	2	
Picka <i>Ochotona roylei</i>	Lata Kharak, Ramni and Dharansi	3,800 to 4,300	4	-	55	
Common Langur (<i>Presbytis entellus</i>)	Belta Kharak	2,700	1	-	25	
	Dibrugetha	3,500	1	-	20	
	Deodi	3,600	1	-	15	

Table 3 - Sighting details of birds

Species	Location	Number of Sightings		Total Individuals
		Direct	Indirect	
Birds				
Himalayan monal <i>Lophophorus impejanus</i>	Lata Kkhark and Saini Khark	2	-	4
Koklas Pheasant <i>Pucrasia macrolopha</i>	Dibrugetha	2	-	2
Chukor partidge <i>Alectoris chukar</i>	Lata Village	1	-	10
Snow partridge <i>Lerwa lerwa</i>	Sathkhol	1	-	1
Himalayan snowcock <i>Tetrao gallus himalayensis</i>	Sarsopatal	4	-	8
Snow pigeon <i>Columba leuconota</i>	Dharansi, Patalkhan and Sarsopatak	10	-	60
Himalayan golden eagle <i>Aquila chrysaetos</i>	Sarsopatal	1	-	1
Himalayan griffon <i>Gyps himalayensis</i>	Lata Kharak to Dharansi	3	-	3
Lammergeier <i>Gypaetus barbatus</i>	Sarsopatal	4	-	4

Table 4 - Comparison of present and earlier faunal survey

Species	Scientific & Ecological Expedition Corp. of Engineers 1993 May- June 52 Days	Clean Nanda Devi Expedition Garhwal Rifles 2001 Sept. 14 Days
Musk deer	31	1
Himalayan tahr	38	11
Blue sheep	990	248
Serow	2	0
Snow leopard	0	2*
Butterflies	28 species	35 species

* Indirect sighting

4.1.3 Butterfly Diversity

The butterflies always attract the entomologist and naturalist due to their aesthetic and scientific value. They play a vital role in Himalayan ecosystem as pollinator and indicator of biodiversity. Arora et al. (1995) documented 80 species of butterflies from NDBR during their four surveys in the area. Baindur (1993) made a list of 27 species from the core as well as buffer zone of NDBR. During the present survey a total of 35 species belonging 25 genera and four families viz. Papilionidae, Pieridae, Nymphalidae and Lycaenidae were recorded from different areas of the park as well as buffer zone (Table 5). Details are given as below:

Family: Papilionidae

Three species of family Papilionidae were recorded during the survey. Yellow swallowtail (*Papilio machaon*) and common blue apollo (*Papilio hardwickei*) were recorded in many places in the alpine area of the park. The common peacock (*Papilio polyctor polyctor*) was recorded in the village fringe of Lata village.

Family: Pieridae

Ten species of family Pieridae were recorded near the village fringe of Lata village and Belta Kharak area. The members of this family preferred the agriculture fields and grassy patches. The dark clouded yellow (*Colias electo fieldii*) was recorded from the alpine areas of the park. *Taraxacum* sp. and *Potentilla* sp. was observed the most preferred host plant of clouded yellow butterfly in this area.

Family: Nymphalidae

Family Nymphalidae was representing maximum number of species recorded during the survey. Sixteen species were observed in different vegetation types in buffer zone and park area. Painted lady (*Cynthia cardui*), Indian tortoiseshell (*Aglais cashmirensis*), Indian fritillary (*Argyreus hyperbius*), Queen of Spain fritillary (*Issoria lathonia*) and comma (*Polygonia-c album*) butterflies were mostly observed in Lata Kharak, Dharansi, Ramni and alpine pasture of Sarsopatal area. Common sailer (*Neptis hylas varmona*), Himalayan sailer (*Neptis mahendra*), chocolate soldier (*Precis iphita iphita*), blue admiral (*Kaniska canace*), large silverstripe (*Childrena childreni*), common tiger (*Danaus genutia*) and plain tiger (*Danaus chrysippus*) were mainly observed near Lata village and Belta Kharak area. The Narrow banded satyr (*Aulocera brahminus*) and *Auocers* sp. was recorded within sub alpine area of Lata Kharak and Saini Kharak area.

Family: Lycaenidae

Six species of Lycaenids butterflies were recorded mainly grassy patches and agriculture fields near Lata village and Belta Kharak area. The Common copper (*Lycaena phlaeas*) and white bordered copper (*Lycaena pavana*) were observed near the village, and azure sapphire (*Heliophorus androcles moorei*), golden sapphire (*Heliophorus brahma*) and sorrel sapphire (*Heliophorus sena*) were most common lycaenids recorded in Belta Kharak area.

Table 5 - Butterflies recorded in Nanda Devi National Park

Family	Species	Common Name	Locations
Papilionidae	<i>Papilio machaon</i>	Yellow Swallowtail	Lata Kharak, Saini Kharak, Dharansi,
	<i>Parnassius hardwickei</i>	Common Blue Apollo	Lata Kharak, Saini Kharak, Dharansi, Sarsopatal
	<i>Papilio polyctor polyctor</i>	Common Peacock	Lata village
Pieridae	<i>Pieris brassicae</i>	Large Cabbage White	Lata village
	<i>Pieris canidia indica</i>	Indian Cabbage White	Lata village
	<i>Pontia daplidice moorei</i>	Bath White	Lata village and Belta Kharak
	<i>Pontia callidice</i>	Lofty Bath White	Lata village and Belta Kharak
	<i>Aporia agathon</i>	Great Blackvein	Lata village
	<i>Aporia leucodice</i>	Himalayan Blackvein	Lata village
	<i>Delias belladonna</i>	Hill Jezebel	Belta Kharak
	<i>Catopsilia pomona</i>	Common Emigrant	Belta Kharak
	<i>Gonepteryx rhamni nepalensis</i>	Common Brimstone	Belta Kharak
	<i>Colias electo fieldii</i>	Dark Clouded Yellow	Lata Kharak, Draransi, Sarsopatal
Nymphalidae	<i>Neptis hylas varmona</i>	Common Sailer	Lata village, Belt Kharak
	<i>Neptis mahendra</i>	Himalayan Sailer	Lata village
	<i>Cynthia cardui</i>	Painted Lady	Lata Kharak, Saini Kharak, Dharansi
	<i>Precis iphita iphita</i>	Chocolate Soldier	Belta Kharak
	<i>Vanessa indica</i>	Indian Red Admiral	Lata Kharak
	<i>Kaniska canace</i>	Blue Admiral	Lata village
	<i>Aglaia cashmirensis</i>	Indian Tortoise Shell	Lata Kharak. Dhransi, Ramni, Sarsopatal
	<i>Childrena kamala</i>	Common Silverstripe	Lata Kharak
	<i>Childrena childreni</i>	Large Silverstripe	Belta Kharak
	<i>Argyreus hyperbius</i>	Indian Fritillary	Lata Kharak, Parkhun Dhar
	<i>Issoria lathonia</i>	Queen of Spain Fritillary	Dibrugeta, Deodi, Ramni
	<i>Danaus genutia</i>	Common Tiger	Lata village, Belta Kharak
	<i>Danaus chrysippus</i>	Plain Tiger	Belta Kharak
	<i>Polygonia-c album</i>	Comma	Lata Kharak, Parkhun Dhar
	<i>Aulocera brahminus</i>	Narrow Banded Satyr	Lata Kharak, Saini Kharak
	<i>Aulocera sp.</i>	Satyr	Saini Kharak
Lycaenidae	<i>Lycaena phlaeas</i>	Common Copper	Lata village, Belta Kharak
	<i>Lycaena pavana</i>	White Bordered Copper	Belta Kharak
	<i>Celastrina huegeli</i>	Large Hedge Blue	Lata village
	<i>Heliophorus androcles moorei</i>	Azure Sapphire	Belta Kharak
	<i>Heliophorus brahma</i>	Golden Sapphire	Belta Kharak
	<i>Heliophoru sena</i>	Sorrel Sapphire	Belta Kharak

4.2 Floral Diversity

Hajra (1983) conducted floral diversity of Nanda Devi National Park during his survey between 1981-82 and described 312 plant species belonging to 199 genera including 81 families. Samant (1993) conducted his floral survey and he was one of the members of the scientific and ecological expedition team. He described 620 species belongs to 344 genera and 116 families. The local community inhabiting in the buffer zone of the park is using plant products as medicine, food and as NTFP collection. They used 97 plant species for various purposes, out of which 117 species are for medicinal purposes (Samant, 1993). During the present survey only 25 medicinal plant species were documented from different forest types viz. broad leaved, sub alpine and alpine pastures (Table 6). The field identification were made with the help of flora of Great Himalayan National Park, by Singh & Rawat (2000) and Flowers of the Himalaya by Polunin & Stainton (1992).

Table 6 – Prominent medicinal plants recorded

Botanical Name	Locality	Habitat
<i>Aconitum heterophyllum</i>	Saini Kharak	Subalpine
<i>Aconitum violaceum</i>	Dharansi, Dibrugheta	Subalpine
<i>Aconitum falconeri</i>	Deodi	Subalpine
<i>Allium humile</i>	Dibrugheta	Sunalpine
<i>Angelica glauca</i>	Deodi, Ramni	Subalpine
<i>Arnebia benthamii</i>	Saini Kaharak, Dharansi, Ramni, Sarsopatal	Subalpine to alpine
<i>Asparagus filicinus</i>	Lata Kharak	Subalpine
<i>Bergenia stracheyi</i>	Bhujgarh	Alpine
<i>Bergenia ligulata</i>	Lata Kharak	Subalpine
<i>Dactylorhiza hatagirea</i>	Lata Kharak, Dharansi	Alpine
<i>Dioscorea deltoidea</i>	Belta Kharak	Broad leaved Forest
<i>Juglans regia</i>	Lata village	Broad leaved Forest
<i>Juniperus communis</i>	Parkhundhar, Sarsopatal	Alpine
<i>Jurinea dololmiaea</i>	Lata Kharak, Dharansi, Bhojgarh, Sarsopatal	Alpine
<i>Meconopsis aculeata</i>	Saini Kharak, Sathkool, Dharansi	Alpine

Botanical Name	Locality	Habitat
<i>Nardostachys grandiflora</i>	Dharansi	Alpine
<i>Picrorhiza kurrooa</i>	Dharansi, Deodi, Ramni	Alpine
<i>Pleurospermum angelicoides</i>	Dibruggheta	Broad leaved
<i>Plantago major</i>	Lata Kharak	Subalpine
<i>Podophyllum hexandrum</i>	Dharansi, Dibruggheta, Deodi	Subalpine
<i>Rheum</i> sp.	Bhujgarh, Sarsopatal	Alpine
<i>Saussurea obvallata</i>	Sathkhol, Dharansi	Alpine
<i>Taraxacum officinale</i>	Lata Kharak, Saini Kharak	Subalpine
<i>Taxus baccata</i>	Lata Kharak, Dibruggheta	Subalpine
<i>Viola</i> sp.	Belta Kharak	Broad leaved

5. Biotic Pressure

5.1 Medicinal Plants Collection

The park area was completely protected and no human interference was allowed since 1982. Only ecological and scientific expedition teams were visited inside the core area of the park after obtaining proper permission. Surprisingly, despite the presence of considerable human population in the buffer zone, no sign of uprooting of medicinal plant was observed during the survey in the park.

5.2 Grazing

During the survey near Saini Kharak, a temporary grazer camp was observed with a herd of about 200 sheep and goats. The prominent livestock grazing signs including pellets of sheep and goats were also observed in Mallah Dharansi area on the way to Hanuman Peak, but no herd was located in this area and the camp was abandoned few days ago. The park front lines staff reported that only few grazers inhabiting in Rani village and they might be using this area. No livestock grazing signs were observed beyond Dharansi pass.

5.3 Pressure by Expedition Team

The mountaineering or trekking expedition teams (ITBP & IMF) visited the core area of the National Park in recent past. They have engaged large number local porters to carry their camping gear and foodstuff. Visiting of many peoples in such areas causing serious disturbance in wildlife habitat by using fuel wood, noise pollution and

uprooting of endangered plant species by the porters etc. Debarking and embossing with name, year and details of expedition organisation were observed in Dibrugheta, Deodi and Ramni on *Abies* and other tree species. Large number of gunny bags full of foodstuff, number of plastic bags and containers was observed lying in Sarsopatal area. The previous expedition team probably left behind those bio-degradable items in this area.

Keeping in view, the Garhwal Rifles named this expedition as **Clean Nanda Devi Expedition** and all team members have collected about 80 gunny bags filled with non bio-degradable garbage from Nanda Devi base camp, Sarsopatal base camp, Devastan, Patalkhan, Trishul, Bithartoli and some other camping sites. All the gunny bags and garbage were exhibit in Garhwal Rifles Officer Mess at Garhi Cantt. Dehra Dun on 24 Nov.2001 and detailed presentation delivered by the Brig. S.S. Patwal, Dr. V. P. Uniyal and Maj. Ajay Kothyal.

6. Recommendations

- Long term ecological monitoring protocol for the park is needed. The protocol will help to research institutions to carryout relevant study for better management of the park. Training on ecological monitoring for the front line staff is also needed.
- Study on ecology, habitat, and distribution of blue sheep in the park would be useful because blue sheep is the most sighted ungulate in this area.
- The patrolling hut of Lata Kharak could be used as a field research station and patrolling staff can be posted to document all field observations.
- The area can be open only upto Dharansi Pass for the tourists with strict regulations includes limitation on the visitors number ideally not more than 10 persons at a time.
- Only trained and registered guide by the park authorities can accompany the tourists.

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