OBSERVATIONS ON STATUS, DISTRIBUTION, HABITAT USE AND FOOD HABITS OF ASIATIC BLACK BEAR (*URSUS THIBETANUS*) IN DACHIGAM NATIONAL PARK, KASHMIR, INDIA.

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Abstract: We carried out observational study from February 2002 to December 2007, with an aim to enhance and update the information on the status, distribution, habitat use and feeding habits of Asiatic Black Bear in Dachigam National Park. Data was recorded on the basis of black bear sightings recorded during regular intensive surveys along trails, *nullahs* (streams) and contours in the fixed five survey blocks and seven trails. During the study period, 466 trail or transect monitoring were carried out in seven transects and five fixed survey blocks of Dachigam National Park, out of which bear sightings were recorded during 350 surveys of Spring, summer and Autumn. Total time and distance effort involved during spring to autumn months was 970 hours and 3009 km. respectively. Asiatic Black Bear sightings were very common (a total of 282 bear sightings) in Dachigam National Park and were dependent on season, bear habit and availability of food. All these sightings were recorded in the Lower Dachigam, maximum (132 sightings) during summer and minimum (53 sightings) during spring Mean Group size varied from 0.71 ±0.17 in spring (March to May) to 1.54 ± 0.16 in summer (June to August). Overall typical Black bear group size was 1.83 individuals a group. During summer the bear showed typical group size of 2.07 individuals in a group. Bear Young/100 adult ratio was highest (49.64 young/100 adult) in summer. Most of the feeding observations were encountered in summer.

Key words: Asiatic black bear, *ursus thibetanus*, Dachigam, Kashmir, *nullahs,* transect, trail, block

Introduction: Asiatic black bear (*Ursus thibetanus*), is one of the four species of bears that occur in India. It is distributed all through the forested habitats of the Greater Himalayas between 1,200 and tree line (3,300 m in Western Himalayas, *c.* 4300 m in Eastern Himalayas and the hills of North East India (> 70 m) (Prater 1980; Sathyakumar and Choudhary 2005). The Himalayan region and the hills of the northeastern India support one of the largest populations of Asiatic black bear in Asia (Sathyakumar 2001). In India, the best known populations of Asiatic black bear are in the State of Jammu & Kashmir in the protected areas of Dachigam National Park (NP), Overa – Aru Wildlife Sanctuary (WS), Limber – Lachipora WS, and Kishtwar NP (Sathyakumar 2001), besides Pahalgam and Pir Panjal Forest Divisions (FD), Naranag – Wangat FD, Tral, Shikargah, Shar, Hapatnar and Daksum areas in Islamabad (Anantnag) district of Jammu & Kashmir.

The habitat utilization and movement patterns of Asiatic black bear in an area depend largely on the density and distribution of key plant food species on which it mainly feeds. In India although it is an omnivore (Sathyakumar 2003), the black bear reproduction is also controlled largely by the food production (Jonkel and Cowan 1971). Existing information on the Asiatic black bear in India is limited to observations by Schaller (1969), observations on food habits and movement patterns ((Manjrekar 1989; Saberwal 1989) of Asiatic black bear in Dachigam National Park and assessment of status and distribution (Sathyakumar 2001; Sathyakumar and Choudhary 2005) and bear – human conflicts and food habits of Asiatic black bear in Kidernath Wildlife Sanctuary, Uttaranchal

(Sathyakumar 2003; Sathyakumar and Vishwanath 2003).

Observations on status, distribution, habitat use and food habits of Asiatic black bear were carried out from February 2002 to December 2007 at Dachigam National Park.

Study Area: Dachigam National Park assumes a great ecological, aesthetic and socio-economic significance as being the only area where the last surviving population of the highly endangered and endemic deer of the Kashmir – The Kashmir Stag or Hangul, besides the endangered Musk deer, Brown bear (*Ursus arctos*) Snow leopard and diverse flora and fauna.

Dachigam National Park (141 km²) ranging from 1700 m. to 4700 m. elevation (Anonymous 1985) lies between 34 ° 05" 00' N and 34° 10" 32' N and 74° 53" 50' E and 75° 09" 16' E in the Zanskar mountain range of Nort-West Himalayan Bio-geographic zone (2A) (Rodgers *et al.* 2000) Fig. 1.

Dachigam National Park is roughly rectangular in shape *ca*. 22.5 km. long and 8 km. wide, and covers roughly half of the catchment area of Dal lake (Holloway & Wani 1977). The valley begins as a broad and narrow bent passage at its entrance facing north- west direction and ends at its south eastern end at Nagberan and at its eastern end at Marsar meadows. Dachigam National Park exhibits a variety of vegetational types manifested by habitat, form and density of dominant species and controlled by a number of factors including habitat conditions, exposure, altitude and above all, the degree of biotic interference (Singh and Kachroo 1978).

Dachigam National Park is ecologically and administratively divided into two sectors, the Lower Dachigam (26 km²) and Upper Dachigam (115 km²) Fig. 1. The lower Dachigam altitude ranges from 1700 m to 3500 m (Anonymous 1985) and thus has a complex mixture of vegetation types with broad leaf mesophyll forest of Maple (*Acer caesium*), Mulberry (*Morus alba*), *Ulmus* spp. *Rhus succidiadiana* and Walnut (*Juglans regia)*, *Hatab* or Pohu (*Parrotiopsis jacquimontiana*) and a variety of conifers such as Deodar (*Cedrus deodara*), blue pine (*Pinus wallichiana*), Spruce (*Picea smithiana*), and Fir (*Abies pindrow*) growing in an altitudinal sequence (Holloway 1971; Singh and Kachroo 1978). Upper Dachigam altitude ranges from 2000 m to c. 4700 m. It comprises vegetation gradient of sub-alpine community of forest followed by scrub vegetation of birch (*Betula utilis*) and rhododendron (*Rhododendron* spp.) interspersed with meadows of herb rich grass lands over 3300 m. This zone gradually merges in to the zone of permanent snow, which is above 3500 m (Holloway 1971; Singh and Kachroo 1978).

Methods: To study and monitor the status, habitat use and feeding habits of the Asiatic Black bear in Dachigam National Park, we designed a standard network of itineraries along trails, *nullahs* (streams) and contours in the fixed five survey blocks and seven trails covering 41.2 km² in Dachigam National Park (Fig. 1). These seven trails and five survey blocks were selected based on altitude, aspect, floristic composition, degree of human disturbances and administrative forest units, i.e. beats (Table. 1; Fig.1). Each itinerary along trails and blocks was monitored on a rotational basis four times a month in different time periods: 9-12 am and 2-5 pm (winter/autumn) and 7-11 am and 3-7 pm (spring/summer) to record the habitat use and feeding habits by black bear (Wilson et al., 1996; Rutledge 1982), to collect data on daily activity patterns of the Asiatic black bear in relation to the habitat and resource availability (i.e., food, shelter and disturbances).

For every sighting of black bear on transects/trails, parameters such as time of sighting; group size and composition: adult and Young bear; activity (feeding, resting, walking or flushing) ; altitude (in m. measured by altimeter and GPS); aspect (North, East, West, South, North east, North west, South east, South west) both visual (ocular) estimation and by GPS; Slope (Flat 0-16 °, Gentle 16- 25 °, Steep 25-34 °, Very steep 34-50 °) determined by visual

estimation; habitat type, and vegetation structure (Riverine, Grassland/Scrub, Pine *Parrotiopsis*, Coniferous, Mix. Woodland, Mixed Morus, Mixed Oak and Grassy/ rocky faces) were recorded.

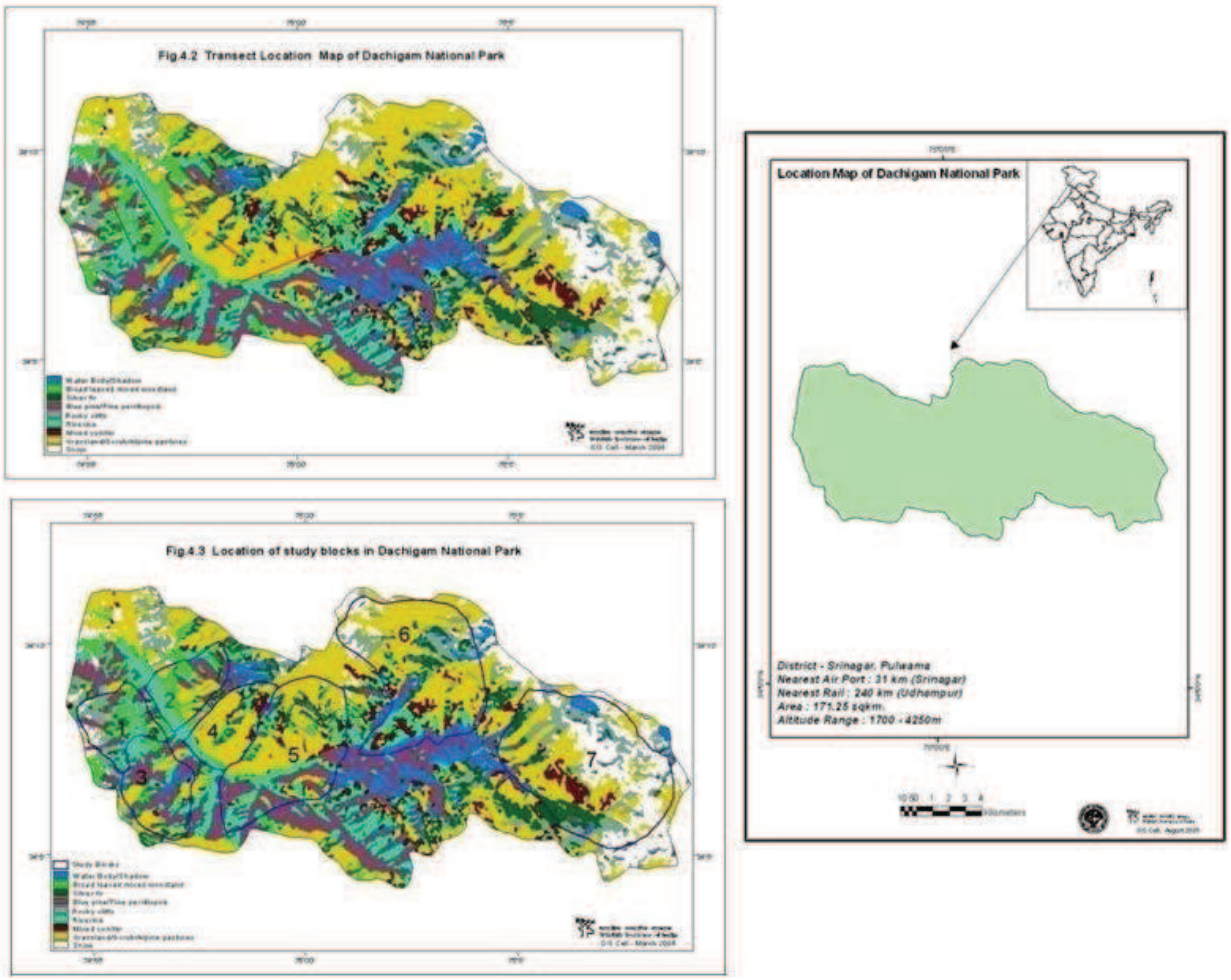


Fig. 1. Location of Dachigam National Park (right) that shows the seven transects (upper left) and survey blocks (lower left) in the Jammu and Kashmir State of India.

Table 1. Distinguishing landscape and disturbance features of Different Study Blocks of Dachigam National Park.

Survey Blocks	Area (Km^2)	Altitudinal Range (m)	Aspect	slope range (o)	Habitat Type	Source of disturbance	Degree of disturbance
1	5.54	1700 - 2300	NW & SW	0-200-200200-	1, 4, 21, 22	1 and 2	Medium
2	5.45	1900 - 2700	N, E & NE	20-40	2, 3, 4, 5	1 and 2	Medium
3	7.43	1700 - 2700	S & SE	0-500-50	1, 2, 4	Nil	Nil
4	6.03	1900 - 2700	E	20-50	3, 5	Nil	Nil
5	16.75	1900 - 2700	E & SE	00-50-50	1, 3, 4, 5, 6	4 and 5	Medium

Legend:

Habitats: 1: Riverine; 2: Mixed Woodland; 3: Grassland/Scrub; 4: Pine *Parrotiopsis*;
5: Grassy/Rocky slopes with Blue pine; 6: Mixed Coniferous; 7: Alpine Scrub

Sources of Disturbances: 1: Fuel & Firewood collection; 2: Grass cutting; 3: Lopping
4: collection of herbs and Medicinal plants; 5: occasional livestock grazing;
6: V. High Livestock Grazing; 7: Pastoral settlements (Cothas & Tents)

Analyses: Asiatic black bear relative abundance was estimated following Burnham *et al.* (1981). The chi-square test and ANOVA were performed for analysis of population data. All statistical analysis were performed on computer Programme SPSS following Norris (1990). The typical group size was computed following Jarman (1974). One way analysis of variance (ANOVA) and Chi-square goodness-of- fit test, were used to find out the significant differences in the habitat utilization of Asiatic black bear based on direct sightings.

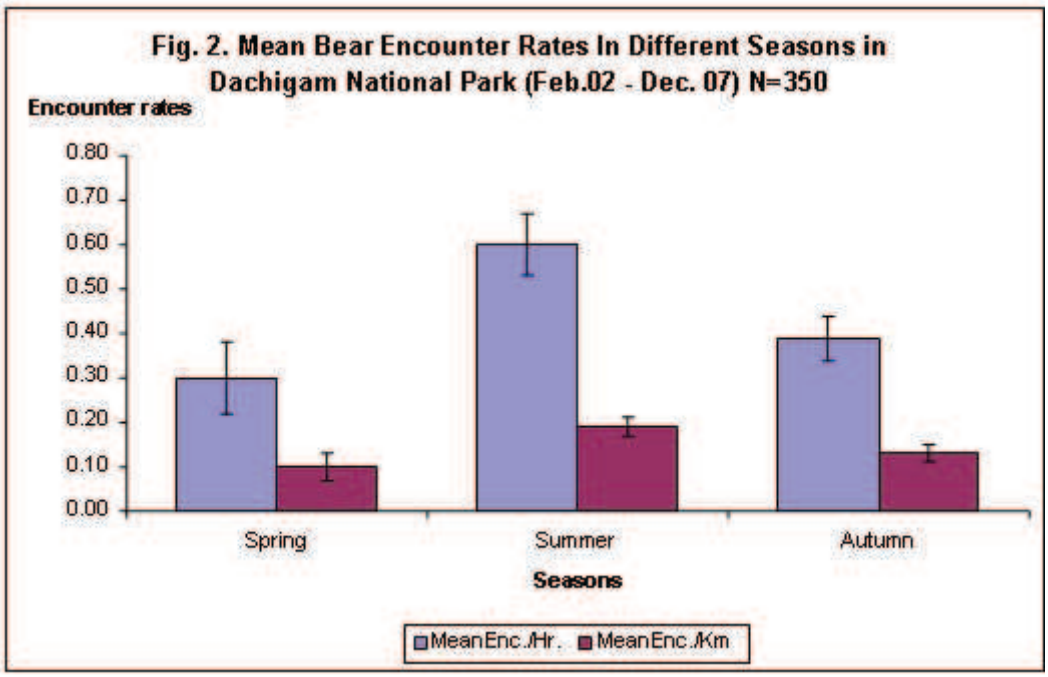
Results

General: The results are based on data recorded during 350 surveys during the three seasons (Spring, summer and Autumn) as no bear sighting was recorded during the winter months (December, January & February). During the study period (February 2002 to December 2007), a total of 466 trail monitoring were carried out in the itineraries along trails, *nullahs* (streams) and contours laid in the fixed five survey blocks and seven trails of Dachigam National Park, out of which 350 surveys were carried out during Spring, summer and Autumn. Total time and distance effort involved during spring to autumn months was 970 hours and 3009 km. respectively (Table 2). A total of 282 bear sightings were recorded during spring to autumn months of the study period. All these sightings were recorded in the Lower Dachigam, maximum (132 sightings) during summer and minimum (53 sightings) during spring (Table 2).

Table 2Distribution of Effort involved and Bear Sightings in Different Seasons in Dachigam National Park (Jan. 02 – Dec. 07)

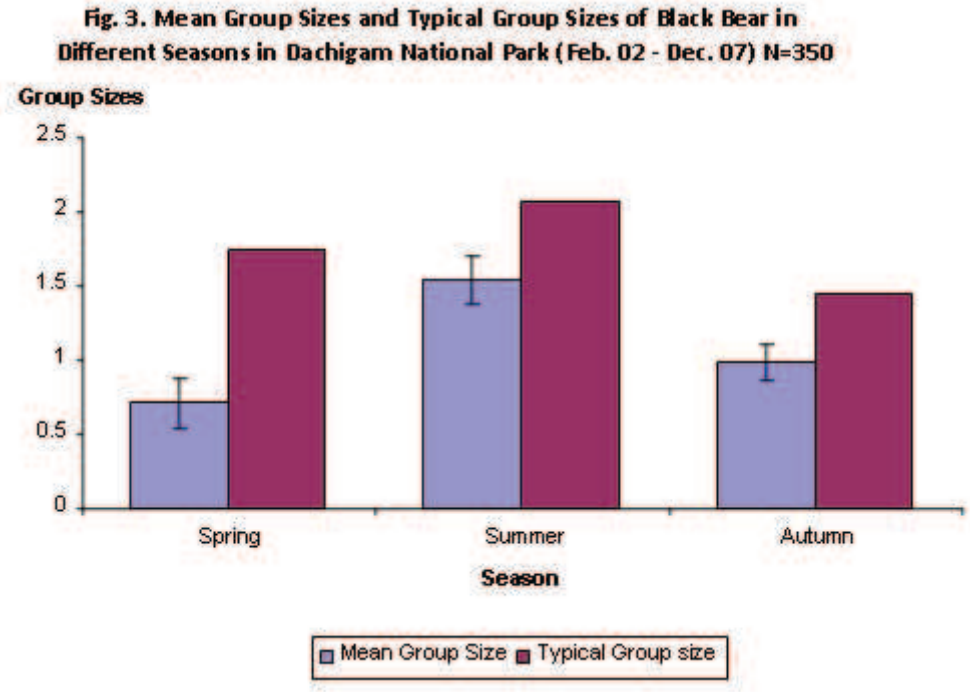
Season	No. of surveys	Total sightings	Total Bear	Adult	Young	Young/ 100Adult	Effort/hr.	Effort/Km
Spring	101	53	72	56	20	35.71	269	805
Summer	133	132	205	137	68	49.64	377	1208
Autumn	116	97	115	101	15	14.85	324	996
Overall	350	282	392	294	103	35.03	970	3009

Encounter rates: Bear encounter rates both per hour effort and per km. walk showed significant differences between different seasons (F= 42.218; P = 0.001 and F= 42.44; P= 0.001 respectively). The maximum bear encounter rates of (0.60 ± 0.07 95% confidence limit c.l. individuals/ hour effort and 0.19 ± 0.02 c.l. individuals/ km. walk) were recorded in summer followed by 0.39 ± 0.05 c.l. individuals/ hour effort and 0.13 ± 0.02 c.l. individuals/ km. walk recorded in autumn. Minimum bear encounter rates of 0.30 ± 0.08 c.l. individuals/ hour effort and 0.10 ± 0.03 C.L. individuals/ km walk were recorded in spring (Fig. 2).



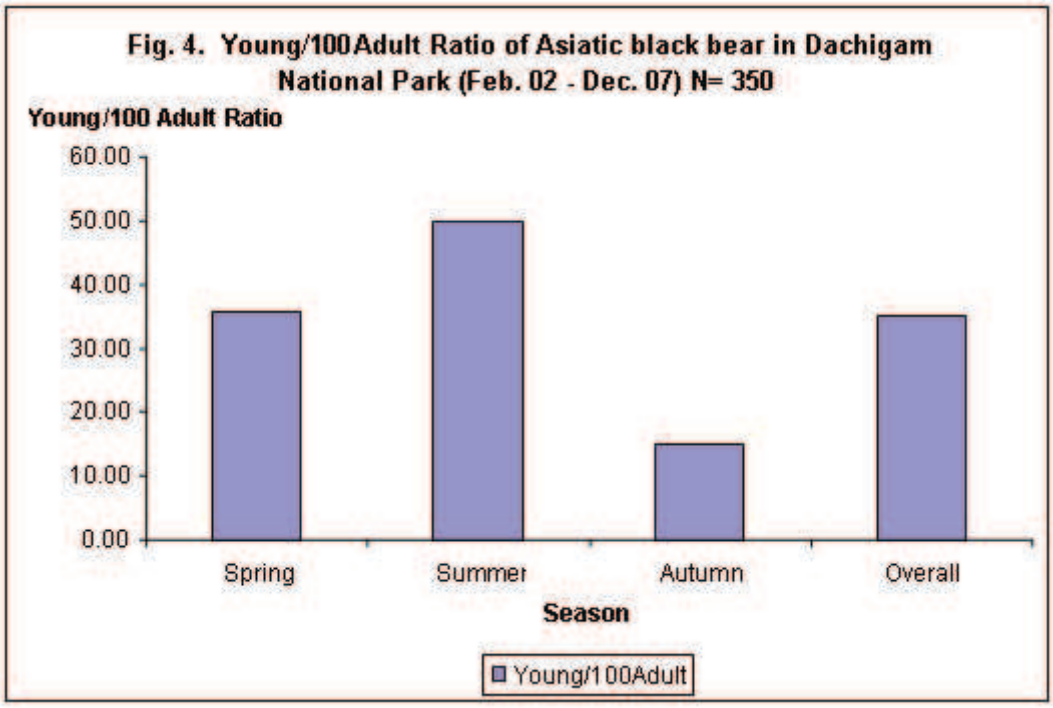
Error bars indicate 95% Confidence limit N= number of surveys

Group size and Composition: The data analysis depicted a wide fluctuation in overall mean bear group size between the seasons. The group size varied from maximum of 6 and 4 individuals sighted in two different observations in summer to 1 individual in most of the sightings in all the three seasons. The overall bear mean group size varied between seasons, it was largest in summer (1.54 ± 0.16 95 % confidence limit (c.l)) followed by (0.99 ± 0.12 c.l) in autumn. The smallest bear mean group size of 0.71 ± 0.17 c.l. was observed in spring (Fig. 3). The overall typical bear group size was 1.83 individuals and it varied between the seasons from 1.45 individuals in spring to 2.07 individuals in summer (Fig. 3).



Error bars indicate 95% Confidence limit N= number of surveys

Young (cub) to adult Ratio: The overall young to adult ratio were 35.03 young/100 adult bear and this ratio showed wide fluctuations during the three seasons. It varied from 14.85 young/100 adult bear in autumn to 49.64 young/100 adult bear in summer. (Fig. 4)



Habitat use: out of 282 bear sightings, for 116 sightings only the habitat use data were collected. The overall bear sightings showed significant differences (40.299; P = 0.001) in different habitat types in Dachigam National Park. The maximum bear sightings (42 sightings) were recorded in Riverine habitat followed by recording of 31 bear sightings in Grassland/Scrub habitats of Dachigam National Park (Table 3). In spring and autumn maximum number of bears (12 and 19 bears respectively) were seen in Riverine habitat followed by sighting of 6 and 17 bears in spring and autumn respectively in Grassland/Scrub habitat of Dachigam National Park. However during autumn 29 bears were seen in Riverine habitat and 13 and 12 bears were seen in Mixed Woodland and Grassland/Scrub habitats (Table 3.1).

Table 3. Overall Bear sightings in Different habitat types in Dachigam National Park

Habitat Type	Bear Sightings	Bear Mean Group size	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Maximum Bear seen
					Lower Bound	Upper Bound	
Riverine	42	1.43	0.63	0.10	1.23	1.62	3.00
Mixed Woodland	22	1.18	0.39	0.08	1.01	1.36	2.00
Grassland/Scrub	31	1.10	0.30	0.05	0.99	1.21	2.00
Pine *Parrotiopsis*	10	1.00	0.00	0.00	1.00	1.00	1.00
Mixed Oak	8	1.50	0.53	0.19	1.05	1.95	2.00
Mixed*Morus*	3	1.67	0.58	0.33	0.23	3.10	2.00
Total	116	1.00	0.68	0.06	0.89	1.11	3.00

(January 2002 to December 2007)

Table 3.1. No. of Bear seen in Different habitat types in different Seasons in Dachigam National Park (January 2002 to December 2007)

Season	Habitat Type	Total Bear Seen	Adult Bear	Young (Cub) Bear
Spring	Riverine	12	10	2
Spring	Mixed Woodland	4	4	0
Spring	Grassland/Scrub	6	6	0
Spring	Pine *Parrotiopsis*	2	2	0
Spring	Mixed Oak	2	1	1
Spring	Mixed *Morus*	0	0	0
Spring	Total	26	23	3
Summer	Riverine	29	21	8
Summer	Mixed Woodland	13	10	3
Summer	Grassland/Scrub	12	10	2
Summer	Pine *Parrotiopsis*	6	6	0
Summer	Mixed Oak	5	3	2
Summer	Mixed *Morus*	5	3	2
Summer	Total	70	53	17
Autumn	Riverine	19	12	7
Autumn	Mixed Woodland	9	9	0
Autumn	Grassland/Scrub	17	16	1
Autumn	Pine *Parrotiopsis*	2	2	0
Autumn	Mixed Oak	5	5	0
Autumn	Mixed *Morus*	0	0	0
Autumn	Total	52	44	8

Food and feeding: Direct observations of various food plants eaten by the bear are presented in Table 4. The frequency ratings (in percentages) for the food plants are given based on number of times each species was observed consumed by the bear. During the study period, a total of 92 bear feeding observations were recorded, 13 observations in spring, 47 observations in summer and 32 feeding observations were recorded in autumn. The species of food plants observed eaten by bear are given in the Table 3. The feeding habits of bear varied widely in different seasons in Dachigam National Park. In spring in most of the observations (38.46% and 30.77% observations) bear was seen feeding on *Arctium lapa* and *Dipsacus mits* respectively, whereas, in summer in most of the observations (31.99% observations) bear was seen feeding on *Morus alba* followed by *Prunus prostate* (in 14.89% observations). In autumn, most (40.63% observations) of the bear feeding observations were recorded on *Juglans regia* followed by 15.63% bear feeding observations on *Rosa macrophylla* (Table 4). Besides direct sightings of plant species eaten by bear, in two observations in summer, bear was seen feeding on ants and once in spring, bear was observed chasing Hangul or Kashmir deer (*Cervus elaphus hanglu*) young ones.

Table 4. Seasonal direct bear feeding observation (percent) on different plant species in Dachigam National Park (January 2002 to December 2007) N = 92

Species	Spring (n=13)	Summer (n= 47)	Autumn (n= 32)
Arctium lapa	38.46	2.13	0
Daldinia comentrica	7.69	0	0
Dipsacus mits	30.77	0	0
Parrotiopsis jaquimontiana	7.69	2.13	0
Quercus robber	7.69	4.26	0
Berberis lyceum	0	0	0
Rosa bageriana	0	2.13	0
Rosa webbiana	0	10.64	3.13
Ferula jaschaina	0	2.13	0
Morus alba	0	31.91	0
Prunus ceresifera	0	10.64	0
Prunus prostate	0	14.89	3.13
Prunus persica	0	6.38	0
Prunus cerasus (wild cherry)	0	2.13	0
Prunus armenica	0	8.51	0
Rosa macrophylla	0	8.51	15.63
Aesculus indica	0	2.13	9.38
Celtis australis	0	0	6.25
Juglans regia	0	0	40.63
Morus nigra	0	2.13	0
Rubus fruiticosus	0	4.26	0
Phagopyrum symosum	0	2.13	0
Prunus pyrus	0	0	6.25
Pyrus communis	0	0	6.25
Rubus hoffeneistrianus	0	2.13	0

N = number of bear feeding observations.

Discussion: The distribution, movement patterns and feeding habits of Asiatic black bear in Dachigam National Park seems to be closely associated with the bear habits, season, topography and the changing vegetation patterns over the seasons. In winter due to the hibernation habit of bears, no bear sighting was recorded in Dachigam National Park. However, it has been reported that Asiatic black bear, hardly go for hibernation in Dachigam National Park (Pratter 1987: Schaller 1969b), but during the study period (January 2002 to December 2007), though surveys were carried out consequently in all the winter months (January, February and December) of 2002-2007, no bear sightings were recorded. Bear in Dachigam National Park might seem to avoid hibernation in situations of dry winter, when they have lot of fallen leaves and acorns available to feed on. This pattern was also observed (but not recorded) during the winter months of 2001 (Pers. observations 2001), which has been a dry winter. However, during the study period, the winters experienced considerable precipitation

(snow and rain), as such possibly no bear sighting was recorded. From the mid spring (end of March) the bear started coming out of hibernation gradually and started to show movements in Dachigam National Parke. As such comparatively lesser bear sightings (53 Sightings) (Table 2) and low encounter rates (Fig. 2) were recorded in spring.

By summer, all bears had come out and all mother bears had already given birth to cubs in spring, and resultantly the bear sightings and bear encounter rates increased (0.60 ± 0.07 95% c.l. individuals/ hour effort and 0.19 ± 0.02 c.l. individuals/ km. walk) (Table 2; Fig. 2) in summer. Consequently, the young/100 adult bear ratio which starts rising gradually in latter half of spring also increases to the maximum (49.64 cubs/100 adult bears) in summer (Fig. 4). Past studies reported Asiatic Black Bear density estimates of 1.3 – 1.8 bears/km2 in Lower Dachigam in high fruit abundance season (June to October) with encounter rates ranged from 0 - 3.5 bears/km walked (Sabarwal 1989).

The availability of diversity of fruiting trees in Dachigam National Park, together with the fresh grassy and herbaceous forage along the ravines, favoured the sighting of comparatively large group sizes in summer and autumn (Fig. 3) than in spring when food availability was scarce.

As is evident from the Table 4, for direct feeding observations, the bear feeding habits varied according to their availability in different seasons in Dachigam National Park. In the early spring, i.e., end of March and beginning of April, there is fresh growth of grasses, herbs, sedges and dwarf shrubs and the flowering of trees along the Riverine and Grassland/Scrub habitats in Dachigam National Park, resulting in the comparatively more utilization of these available grasses, and herbs by the bear and sighting of considerably more numbers of Bear in Riverine and Grassland/Scrub habitats of Dachigam National Park during spring and summer (Table 3 & 3.1).

While as in summer, all the fruiting trees are in bloom, and there is abundant food available to the bear, resulting in the increase in the bear feeding observations. Maximum numbers of bear (29 bears) in summer were recorded in Riverine habitats followed by 13 bears seen in Mixed Woodland and 12 bears seen in Grassland/Scrub habitats (Table 3.1) since fruiting trees such as *Morus alba*, *Prunus prostate*, *Rosa webbiana* and *Rosa macrophylla* (Table 4) on which most of the bear feeding observations were recorded are distributed along these habitats in Dachigam National Park. In autumn most of the bear feeding sightings (27.08% sightings) were recorded on *Juglans regia,* which could be a reflection to protein content in this species which is more required by the bear in autumn to help store protein and fats for coming winter hibernation period. Similar observations have been observed and discussed by Manjrekar (1989). Since *Juglans regia* trees and *Rosa macrophylla* shrubs are also distributed mostly in the Riverine and Grassland/Scrub habitat, as such more numbers of bear (19 and 17 bears) respectively were seen in these habitats in autumn in Dachigam National Park.

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