Winter Behaviour of the Himalayan Pika, *Ochotona roylei*[1)2)3)]

By

Takeo Kawamichi

Zoological Institute, Hokkaido University

(With 9 Text-figures and 1 Table)

Within the Order Lagomorpha, the pikas occupy a distinguished position by their mode of life and behaviour quite different from those of hares and rabbits. There are numerous fragmentary observations on their ecology and ethology but few detailed work except those by Loukashkin (1940), Hayward (1952) and Haga (1960), apparently caused by their habitat preference for high altitudes or barren lands inaccessible to research workers. Moreover, most of the previous biological informationsdeals with the species belonging to the subgenus *Pika* Lacepède which occupies the northern half of the Holarctic distribution range. There is practically no detailed report upon the species of the subgenus *Ochotona* especially inhabiting the southern areas, except several brief notes.

From December 1967 to February 1968, that is the winter season under local climate, the author made a series of observations upon the habits of the Himalayan pika, *Ochotona* (*Ochotona*) *roylei* (Ogilby)[4)] in Gosainkund area, Central Nepal Himalaya. Leaving detailed descriptions elsewhere, the present paper deals with some important results obtained through this survey. Besides the reason mentioned above, the Nepal Himalaya was chosen by another particularity. Skinner (1925) recorded that *O. princeps* (Richardson) in Rocky Mountains performed some extranidal activities on fine winter days. Many other northern forms also seem to have winter extranidal activities, though the information is still fragmentary. Concerning the southern forms, Hingston (1925, after Hayward) recorded their hibernation in Himalaya, while Biswass and Khajuria (1957)

1) Studies on the genus *Ochotona* Link, (Mammalia, Lagomorpha, Ochotonidae) I.

2) Contribution No. 829 from the Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan.

3) Contribution from the Tethys Society, Hokkaido University No. 12.

4) Four specimens (3 ♀♀ and 1 ♂) captured in Gosainkund area (St. A & B) were identified to *O. roylei* by Dr. H. Abe, together with nine specimens captured by himself in the same area in June ,1968. The identification was based upon the key by Ellerman and Morrison-Scott (1951), who listed 12 "species" with 49 subspecies recorded from Asia, and two species from Nepal, *O. roylei* and *O. macrotis* (Günther).

collected one specimen in winter. Observations during winter were assumed to be fruitful in the Himalayan areas, for the weather is relatively fine and calm, and snow soon melts away at least at altitudes lower than 4,000 m.

Habitat preference

The Nepal Himalaya occupies the central 800 km part of the Himalayan System, which stretches 3,000 km from Upper Burma nearly to Afghanistan, covering the areas between 72° and 91°E. and 27° and 36° N. Two local seasons, generally recognized as dry and monsoon, could be subdivided into four, by regarding temperature condition (hottest in July and coldest in Jan.): Premonsoon (Mar.–May, warm and moderately rainy), monsoon (Jun.–Aug., hot and heavily rainy), postmonsoon (Sept.–Nov., cool and moderately rainy) and winter (Dec.–Feb., cold and dry). According to Mani (1962) the vertical distribution of vegetation shifts in general from lower valleys upwards as follows; 1. Broad leaf monsoon forests (=wet forests), 2. Broad leaf sclerophyll forests (=so-called oak-rhododendron forests or "lucidophylous" forests in the Japanese school), 3. Spruce-fir coniferous forests, 4. Dwarf or bush rhododendron zone, 5. Narrow birch-juniper

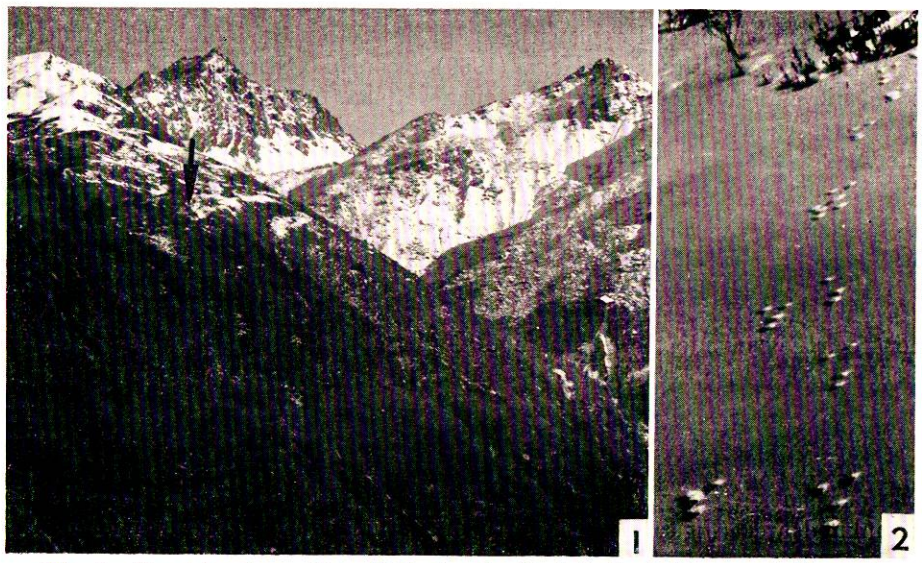

Fig. 1. Gosainkund area (Dec. 1967), showing St. A (indicated by arrow). The peaks at the back are about 5,000 m alt.

Fig. 2. Foot prints of pikas on snow at St. A.

belt, 6. Alpine meadow of high plateaux, 7. Exposed slide rock areas. The timber line is about 4,000 m high and the snow line about 4,500 m in the southern slope of the Nepal Himalaya.

The author found old excrements of pikas at 2,800 m, which was the lowest point where the presence of the pikas was confirmed. The highest point surveyed by the author is 4,300 m, where numerous nest holes and piled excrements were found. Indubitably they reach much higher altitudes. Another Himalayan form, *O. macrotis wollastoni* Thomas & Hinton is recorded at 20,100 ft (=6,126 m) on Mt. Everest (Thomas and Hinton, 1922). Within this wide vertical range covering diverse vegetations, the existence of the pika is limited by their particular habitat preference. They can survive only in the areas provided with ample subterranean cavities formed by accumulations of loose slide rocks. Such areas, usually detectable from the surface by bare grounds consisted of poor vegetation and exposed rocks, are found from just a little below the timber line upwards, scattered either in forests, scrubs or in alpine meadows, probably continuous to high rocky peaks. Occasionally forests can grow on such rocky areas, where the pikas use subterranean spaces around root systems and below fallen trees. But they do not penetrate deeply in forests without rocky grounds. They also avoid unstable areas covered by small movable rocks, but, as far as interconnections of rocks are firm and stable, there seems to be no particular preference to the size of rocks. Similar rocky areas are also abundunt at altitudes of 2,100～2,300 m, but these are exclusively used by smaller rodents, never by pikas.

At present no crucial explanation is given as to the factors which limit their presence at high altitudes. Haga (1960) recorded an increased sensitivity to pneumonia and aspergillosis, of the Japanese pika, *O.* (*Pika*) *hyperborea yesoensis* Kishida, when they are kept under lowland conditions, just comparable to the symptoms shown by the Antarctic penguins kept under temperate climate. Therefore, it seems that thermal condition is one of the important limiting factors. On the other hand, their presence in both dry grassy grounds and wet forests suggests the tolerance to humidity conditions. The final solution of the factors limiting their ecological distribution is open to further studies.

An interesting case of their synanthropic tendency is recorded. In Gosainkund area, they invade the summr huts of the natives, "kalkha". The side walls of the huts are 45 cm wide, made by piling flat stones, and numerous deposits of excrements were found among these stones. In the hut where the author stayed, they occasionally invaded inside or ran on the roof, both by day and night, although the nests were presumably not built within the walls.

Four stations were chosen for closer observations of behaviour, three in Gosainkund area (Fig. 1), 42 km north of Kathmandu and one in Drandi Khola area. Main topographical and ecological conditions of these stations are summarized in Table 1.

Observations of winter behaviour

Through the author's survey, it was definitely confirmed that *O. roylei* does not hibernate, or exactly, not cease their extranidal activities in winter, at

Table 1. Conditions of four stations chosen for continuous observations

Name	A	B	C	D
Location	Upper boundary of Gosainkund village	Between Dounche and Gosainkund villages	Near Thare Pati, south of Gosainkund village	Upper course of Drandi Khola, northern valley of Gurkha
Altitude	4,300 m	3,300 m	3,500 m	3,300 m
Vegetation	Rhododendron and alpine scrub, soon above coniferous forests	Grassy ground used for grazing	Juniper-rhododendron forest, soon below of timber line	Grassy ground used for grazing in rhododendron forest
Topography	Northwestern slope, mostly covered with snow (cf. Fig. 1)	Southern slope, without snow cover (cf. Fig. 6)	Western slope, mostly covered with snow	Southern slope without snow cover
Insolation	Intense	Slightly intense	Moderate	Intense
Period observed	XII 13~21,'67	XII 22~31,'67	II 9~16,'68	I 16~27,'68
Weather during observation	Fine (18 days), cloudy (6 days) and snowy, less than 10 cm deep (4 days)			Fine (5 days), cloudy or foggy (4 days) and heavily snowy, 30 cm deep (one day)
Temperature during observation (including night)	Absolute minimum −8°C, mean minimum −5.5°C, mean maximum 4.8°C, absolute maximum 7°C	Absolute minimum −5°C, mean minimum −0.9°C, mean maximum 10.5°C, absolute maximum 15°C	Mean maximum 5.9°C absolute maximum 9.6°C (Minimum temperature was not measured.)	Absolute minimum −8.3°C, mean minimum −5.8C°, mean maximum 6.7°C absolute maximum 12.5°C
Remarks		In summer used for grazing of cattles and sheeps		As in B

least at the altitudes where observations were made. The individuals observed made extranidal excursions every day, both by day and night, but most frequently at dawn and dusk, traversing a long distane with taking food in their home range (=*morning* and *evening trips*). Their movements are consisted of *running* and *leaping*, intervened by "*musing*" and *food intake*. The course of daily excursions is

quite fixed so several pathways connecting nest holes were clearly marked on grounds.

The patterns of elementary behaviour do not much differ from those seen of *O. hyperborea yesoensis*, observed in Hokkaido (Kawamichi, unpubl.). Brief remarks are given below for each of main behaviour patterns.

Running and *leaping*: Both ways are used for locomotion. Judging from foot prints on snow, leaping is similar to that in hares (Fig. 2) in spite of short hind paws.

"*Musing*": This means the motionless sitting on rocks or on edge of cliffs. Two kinds of musing are distinguishable. *Brief musing* is prevailing during daytime and continues for several seconds to several minutes. The animals are relatively alert, often stop this posture by turning head, or making *self-cleaning*, scratching head, ears and back with a hind paw, or cleaning face by both fore paws moved alternatively. *Prolonged* or *deep musing* appears at dawn and especially at dusk. It continues several minutes or more, up to 15 min. The animals sit without making particular movement, gradually rounding the bodies, as if they are sleeping.

Fig. 3. Pika eating fallen leaves on snow near the snow hole (indicated by arrow) at St. A.

Fig. 4. Pika warning to the author near the nest hole at St. D.

Intake and transport of food: The main food-stuff is consisted of fresh grasses, herbs, fallen leaves, mosses and leaves of dwarf bamboos.[1] Food-stuff is different among stations, but these are dominant or plentiful at each station. The food is eaten at the spot or carried to safety places, crevices and fissures among rocks or nest holes (Fig. 3). Both at eating and transporting, fore paws are not used. When they take leaves issuing from higher levels, they can reach the food by erecting

1) Now under identification of species.

their body and putting their fore paws on the stalks. The abuse of fore paws at taking food is known also in *O.* (*Ochotona*) *daurica* (Pallas), and *O.* (*Pika*) *hyperborea mantchurica* Thomas, both in North Manchuria, (Loukashkin, 1940), and *O. h. yesoensis* in Hokkaido.

Absence of calls: One of the most peculiar habits separating the pikas from the other members of Lagomorpha is their calls, as shown by their other name, the piping hare. During the present survey covering 41 observation days, however, no high and sharp calls, so characteristic in the northern forms, could be heard. Only very weak cries, described as something like "quets", were heard only thrice, two times when the author suddenly approached to a running pika, and one when a pika entered into a nest hole just under observation by the author at a distance of a few metres (Fig. 4). The absence of high and sharp calls in *O. roylei* was also noticed by Dr. H. Abe, a member of the Hokkaido University Scientific Study Trips to Nepal Himalaya, in Gosainkund area on June 3～7, 1968.

From these facts, it may be concluded that *O. roylei*, at least in their populations inhabiting Gosainkund and the vicinity, produces weak cries but no high calls so characteristic in their northern relatives. High calls in *O. h. yesoensis*, produced by an individual are frequently responded by the neighbours (Sakagami *et al.*, 1956), and the calls are regarded as a device of communication among individuals. The absence of this call in the Himalayan pika, therefore, offers an interesting problem to the adjustment of social relations.

Fig. 5. Snow hole at St. A.
Fig. 6. View of St. B, showing habitat of pika characterized by abundant slide rocks.

Structure of burrows within snow cover : Station C was mostly covered with snow and the pikas frequently appeared from the holes made in snow cover (Fig. 5). The excavation of an area, 3.5×4.4 m. sq. exposed the presence of a labyrinthine

system of intrasnow burrows (Fig. 7). The snow cover was 30～40 cm in depth and the burrows were dug at 10～15 cm above the ground, approximately transversely circular in cross section, 5～7 cm in diameter. There were several *snow chambers* at the middle of some burrow sections, circular with concave bottom in cross section, 8～9 cm high and 12～17 cm long. The area excavated by the author was the ground without exposed slide rocks, with thick growth of rhododendron bushes. It seems that the pikas cut all twigs of rhododendron that obstacled construction of intrasnow burrows, as many neatly cut ends of twigs were found on the walls of the burrows.

The significance of intrasnow burrows is obvious. The pikas can move, in these burrows, without decreasing their activities in winter, protected more safely from severe cold and from natural enemies than in summer. The complicated system shown in Fig. 7 extended to a rhododendron bush closely nearby, suggesting the burrows were mainly dug to harvest and transport leaves and twigs. The food does not always transported into their proper subterranean nest at least a part is consumed within the snow burrows, especially in snow chambers, as suggested from scattered remains of twigs in the latter. The bottoms of these chambers, in contrast to those of other sections of burrows, are not formed with snow but loose ice caused by their body heat, indicating their stay for a considerable time.

The communal use of this burrow system by more than one individual is obvious, because at least two individually recognized animals were observed at snow holes. The diameter of burrows is so narrow to allow the passage of two individuals at a given time. At encounters snow chambers or short blind burrows seen near the entrances may serve as sidetracks. No excrement was found within burrows. This fact shows that the pikas "regard" snow burrows as an extension of their subterranean nest burrows.

Diurnal rhythm of extranidal activities: Although extranidal activities are made at night, these are most intense at dawn and dusk, as shown in several continuous observations in Fig. 8. The figure shows more intense activities at Station A (cf. Fig. 1), higher than the others (cf. Table 1), where pikas were earnest in taking food and musing under strong solar radiation and snow reflection. Extranidal activities at the other two stations belong to Station B type. The pattern of daily extranidal activities, more or less similar at all four stations, is described as follows, mainly based upon observations at Station B, where two animals, X and Y (adult male and female, confirmed later by capture), were recognized individually by scars in ears, hair coat and other minor peculiarities (Figs. 6, 8 and 9).

As in the other cases observed, the two individuals in Station B possessed several resting places, or exactly said, they appeared from several selected nest holes, the departure from, and entry into which were more frequent and the duration between entry and departure longer. These resting places were used

by X and Y, although the subterranean system was not investigated. Usually one resting place has several nest holes and several musing points within a few metres of it.

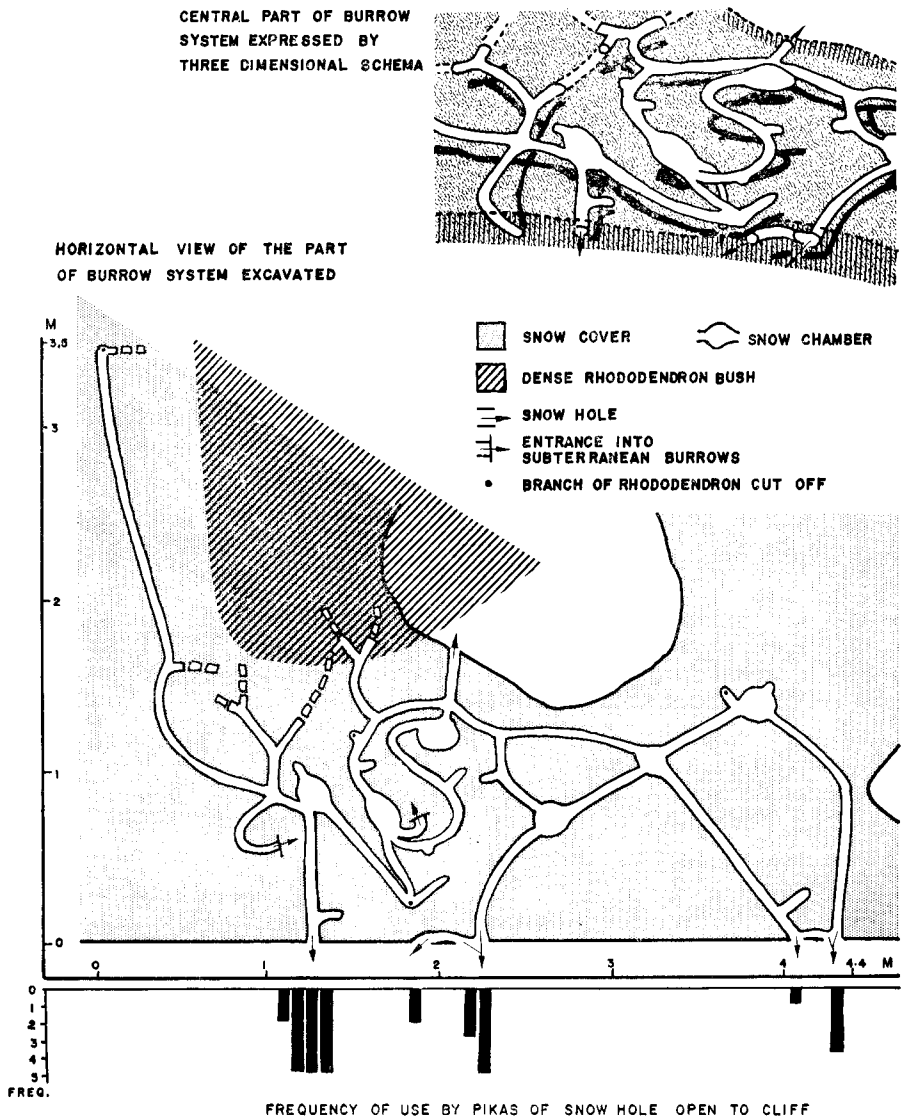

Fig. 7. Structure of a snow burrow system studied at St. C (excavated on Feb. 20, 1968) Frequency is given by total counts of show hole passing, observed within 52 hrs. covering 6 days.

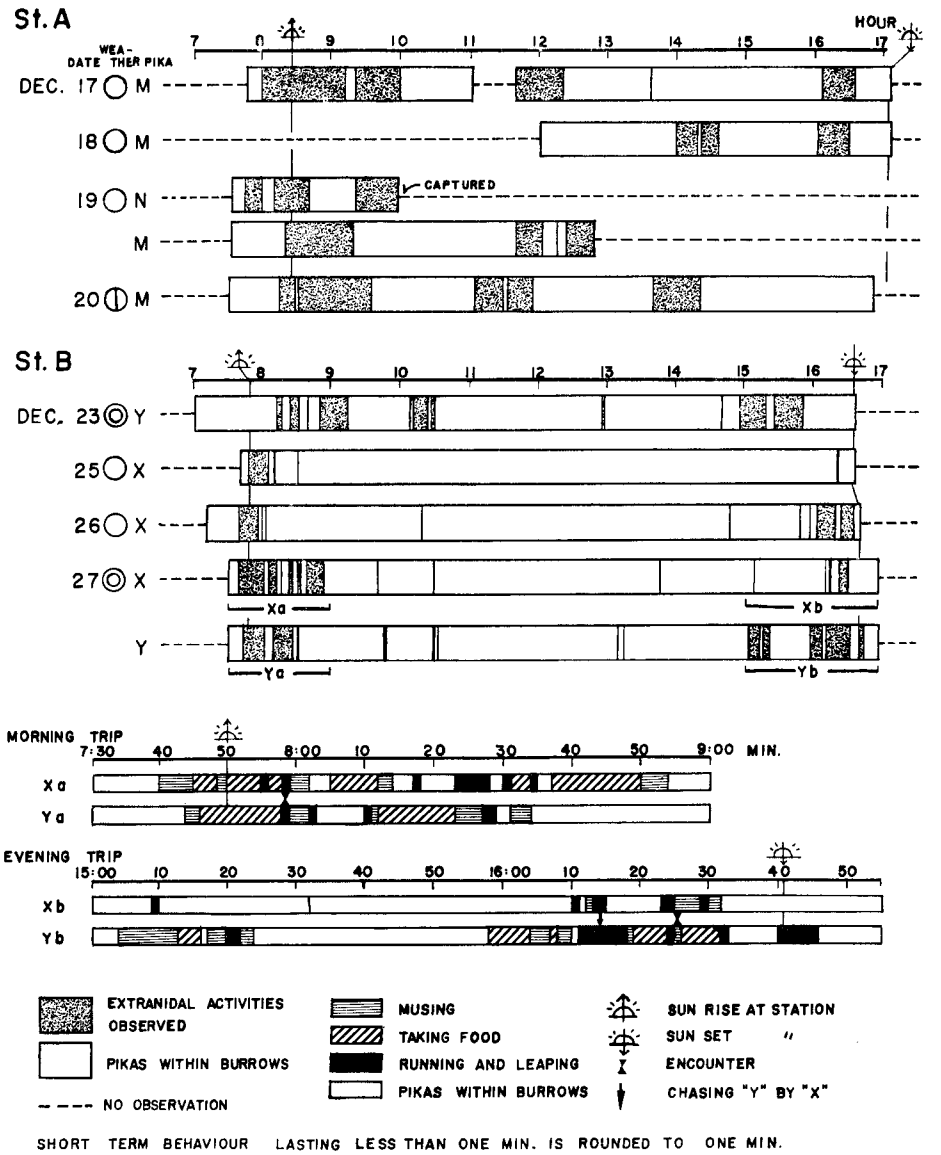

Fig. 8. Diurnal rhythm of extranidal activities at St. A and B. Closer behaviour sequence at St. B (Dec. 27) is given at bottom.

At the first departure from a nest hole at dawn, they make deep musing near the hole. Then they make morning trip at 7:30～9:00, variable according to stations but nearly synchronous among individuals in the same station. The

morning trip continues 30～60 min., visiting many areas and taking food (Fig. 8). Thereafter, during 9: 00～15:00, they go out only briefly and movements from one hole to another become quick and straight, fairly different from the wandering in morning and evening trips.

At dusk extranidal activities again develop at 15:00～17:00, making excursions intervened by food intake and deep musing which is the longest during daytime.

The first departure at dawn and the last entry after sunset are usually observed at one resting place, but occasionally they enter another resting place, and appear from it on the next morning. Because they always make extranidal movements among resting places separated by considerable distances, it is plausible that they can have more than one subterranean burrow system independent of one another, and occasionally stay in different systems from day to day. Such inter-burrow translocation may depend on the topography of the home range. When a home range covers two slide rock areas, separated by a wide stretch of grassy land, the pikas often make an excursion from one area to the other, stay in the latter during daytime and do not return to the first area until evening trip, or even overnight in the second area. On the other hand, when two rocky areas are not much separated, they repeat to go and return from one area to the other within a same day.

Home range: The size of the home range was estimated for the two individuals, X and Y, observed in Station B, cited above (Fig. 9), to be 30×42 m. sq. (actual extent 82 m^2) and 25×39 m.sq. (actual extent 83 m^2) respectively. The total size of the range possessed by the two individuals, on the assumption that they form a social unit, is 30×42 m. sq., about 60% of which are actually used communally. The figure may underestimate the actual size, because the trips to the forest standing at west side of the area observed were occasionally seen. The vegetation disturbed direct observations on their behaviour, but probably they did not invade deeper than 10 m into the forest, judging from the distribution of excrements there. The encounters with X and Y seem rarely accidental but mostly "consciously". The social behaviour will be described elsewhere. Their responses at encounter indubitably show the occurrence of a relation suggesting a social order. Chasing of Y by X was observed several times. As X and Y were an adult male and female respectively, it is conceivable that the case in Station B means the possession of an area by a pair. But social structure of the pikas seems to be more complicated. In Station D, three pikas were observed making musing synchronously within the distance less than five metres. In the same station, but at the different section, one nest hole was used by at least three to five other individuals.

Hoarding: The hoarding is another ethological characteristic of the pikas. In the northern forms, a considerable amount of vegetable matters is accumulated at fissures of rocks for winter. Such large hoardings were, however, not found in *O. roylei*. The accumulations of 10～20 pieces of plants were found here and

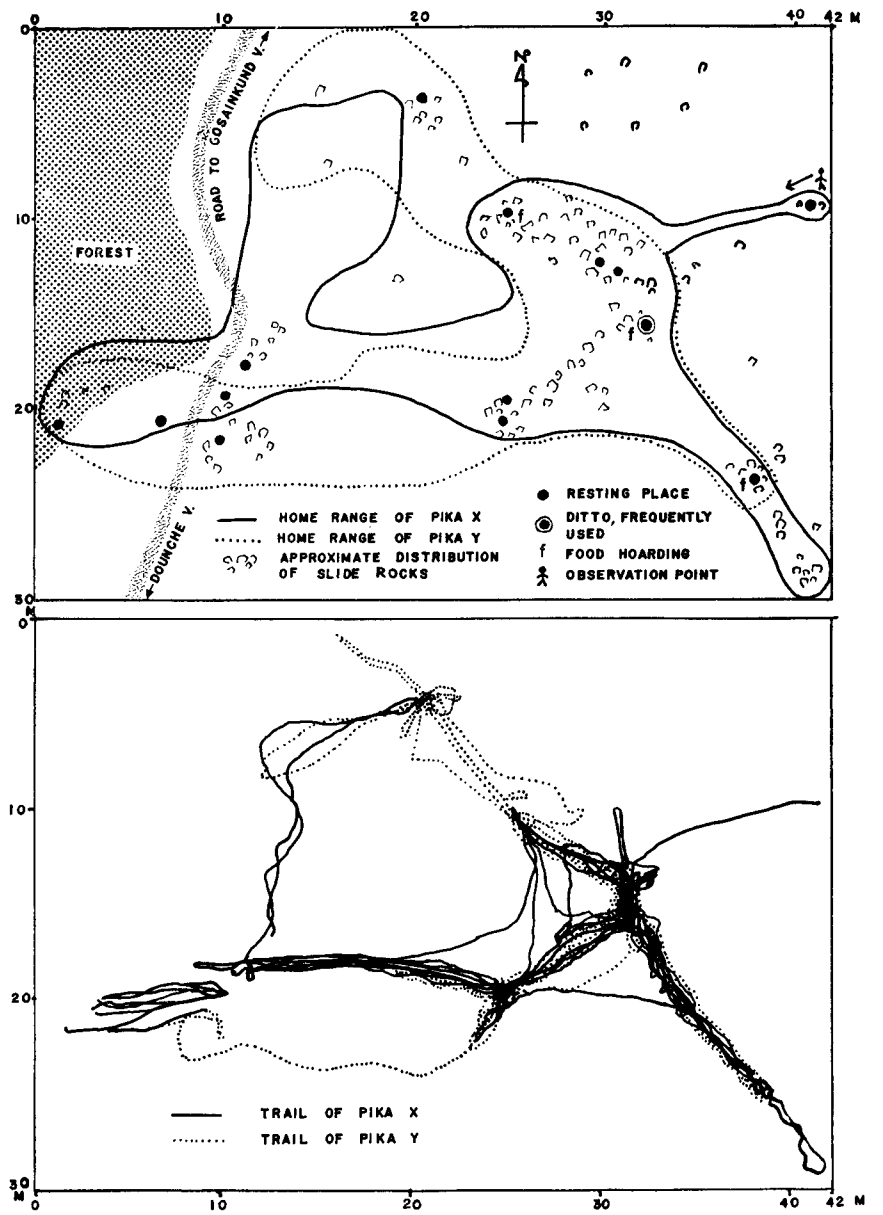

Fig. 9. Home range of two pikas at St. B (top), together with their trails recorded during four days (bottom).

there, usually at fissures of rocks protected from rain. The biggest pile was consisted of only two handful grasses and twigs, containing 159 pieces, found at Gosainkund area (3,600 m alt.). The total amount of hoardings found within a home range is very small, even regarding the biggest one mentioned above. For instance, within the home range possessed by X and Y in Station B, only three hoardings, each consisted of 10～18 pieces, were detected (Fig. 9). From the whole area of Station B, there were found 94 nest holes (judging from the presence of excrements) and 17 hoardings scattered here and there, mostly within the central area, 25×20 m. sq. with 49 nest holes. Among 17 hoardings, nine contained less than 10 plant pieces and eight 10～20.

Such poor hoardings are quite different from the following records known of the northern forms: *O. daurica* and *O. h. mantchurica*, 2～5 lbs. (=0.9～2.3 kg) in dry weight (Loukashkin, 1940); *O. h. yesoensis*, one unfinished stack 3.5 kg (Haga, 1960); *O. pallasi pallasi* (Gray), "pile or abundant remains of grass and flower stalks" (Allen, 1938); *O. princeps saxatilis* Bangs, "14 1/2 ozs. totally. Of this amount 4 ozs. are consisted of 5,000 pieces" (Beidleman and Weber, 1958).

Considering the smaller amount of hoardings together with continuous extranidal activities in winter and the fact they sometimes harvest food into these hoarding places even in winter, it is concluded that *O. roylei* does not make large hoardings for winter as known in some northern relatives.

Miscellaneous notes: As in *O. h. yesoensis*, *O. roylei* produces two kinds of excrements, one the usual dry dung of globular shape and the other a soft one which is, according to Haga (1960), eaten later by themselves, showing a peculiar coprophagy. Generally these two kinds are separately found but sometimes soft excrements and a few to 14 pieces of dry one are found in mixture. The pile of excrements are mostly found at resting places, especially at flat places protected from rain, suggesting they stay there for a considerable time.

O. roylei has a clear musty body odour, which is perceived also from soft excrements and from fissures of rocks frequently used by them. A similar odour is known in the Uinta pika, *O. princeps uinta* Hollister (Hayward, 1952), but in *O. h. yesoensis*, a very weak odour can be noticed on bodies and soft excrements only with careful examination.

About the natural enemies many orange coloured mites were found on all the captured specimens especially within ears. A weasel (*Mustela* sp.) once invaded a nest hole and one pair of Yellow-throated Marten (*Martes flavigula* (Boddaert)) regularly cruised the habitats and always waited pikas at nest holes, but actual attack was not observed.

The author is indebted to Prof. M. Yamada and Dr .Sh. F. Sakagami for their kind guidance in the course of the present study. He wishes to express his deepest appreciation to Dr. H. Abe for valuable technical advices and the identification of the specimens captured.

Summary

Winter behaviour of the Himalayan pika, *Ochotona* (*Ochotona*) *roylei* (Ogilby) was observed at Gosainkund and Drandi Khola areas, Central Nepal Himalaya, from December 1967 to February 1968. This species is distributed in altitudes from 3,000 m upwards at least to 4,300 m, certainly to much higher altitudes. As in the northern relatives, the preferred habitat is the areas provided with ample accumulations of loose slide rocks. The general behaviour accords with that of the northern forms, with three noticeable departures as follows: 1) extranidal activities continue during winter, 2) apparently in connection with the fact mentioned, the amount of hoardings is very small, and 3) any high calls very characteristic in northern forms are not recorded.

Detailed studies with individually recognized animals proved: 1) typically bimodal diurnal rhythm of activities, with peaks at dawn and dusk, 2) construction of a complicated burrow system within snow cover, and 3) possession of home range of at least 30×42 m.sq., usually occupied by more than one individual.

References

Allen, G.M. 1938. The mammals of China and Mongolia, Natural History of Central Asia. Amer. Mus. Nat. Hist. **11**: 523–557.

Beidleman, R.G. and W.A. Weber 1958. Analysis of a pika hay pile. J. Mamm. **39**: 599–600.

Biswass, B. and H. Khajuria 1957. Zoological results of the 'Daily Mail' Himalayan Expedition, 1954. Notes on some mammals of Khumbu, Eastern Nepal. Proc. Zool. Soc., Calcutta, Mookerjee Memorial Volume: 229–253.

Ellerman, J.R. and T.C.S. Morrison-Scott 1951. Checklist of Palaearctic & Indian Mammals. 810 pp. (esp. 445–456) Brit. Mus. (Nat. Hist.), London.

Haga, R. 1960. Observations on the ecology of the Japanese pika. J. Mamm. **41**: 200–212.

Hayward, C.L. 1952. Alpine biotic communities of the Uinta mountains, Utah. Eco. Mono. **22**: 93–120.

Hingston, R.W.G. 1925. Animal life at high altitudes. Annual Rep. Smiths. Inst. 1925: 337–347 (cited from Hayward, 1952).

Loukashkin, A.S. 1940. On the pikas of North Manchuria. J. Mamm. **21**: 402–405.

Mani, M.S. 1962. Introduction to high altitude entomology. xix+302 pp. Methuen & Co. Ltd., London.

Sakagami, Sh. F., Mori, H. and H. Kikuchi 1956. Miscellaneous observations on a pika, *Ochotona* sp. Inhabiting near the Lake Shikaribetsu, Taisetsuzan National Park, Hokkaido. J. Appl. Zool. **21**: 1–9.

Skinner, M.P. 1925. Winter movements of the cony. J. Mamm. **6**: 202.

Thomas, O and M.A.C. Hinton 1922. The mammals of the 1921 Mount Everest Expedition. Ann. Mag. Nat. Hist. Ser. 9. **9**: 178–186.