## **FINAL REPORT**

PROJECT TITLE: INVENTORY AND COMPARISON OF MOTH COMMUNITIES INHABITING DIFFERENT FOREST ECOSYSTEMS IN THE FOOTHILLS OF THE KUMAON HIMALAYA, INDIA DURATION: Sept. 15, 2006 to Dec. 31, 2007

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## INTRODUCTION

This project aimed to discover the altitudinal distribution of Himalayan moths by monitoring two sites in the outermost range of the Kumaon Himalaya, namely at Maheshkhan (2200m elevation) and Ranibagh (400m elevation). Comparative data from Bhimtal (1500m elevation), which lies between the two abovementioned sites, had been compiled over several decades.

## METHODOLOGY FOLLOWED

In 2006, it was not possible to obtain a place on rent in the vicinity of Maheshkhan Reserve Forest as intended. Therefore, a station was established at Jilling Estate (2400m) some ten kilometers east of Maheshkhan. Since it was late in the year (October) there were few moths about at that elevation.

Meanwhile, a station was established at Ranibagh and there were plenty of moths about in the post-Monsoon brood at that elevation (400 m). By mid December, moth activity died down and there was nothing on the wing in January and February.

The moth season should have started in late February/early March, but there was such unprecedented inclement weather in March 2007 that there was nothing on the wing, either in Ranibagh or Bhimtal. Any activity at Jilling was out of the question in such weather.

Activity began in mid April, when we monitored Ranibagh. In summer we shifted the high elevation station to Gagar, where we established a station behind the Post Office. Gagar (2400m) is on the crest of the outermost range and is contiguous with and above Maheshkhan. Location wise, it was perfect, even better than the originally intended location at Shyamkhet, which is below Maheshkhan.

The Gagar station yielded much interesting information and some potentially undescribed species through the summer.

In addition to moths, we took mantids, beetles, lacewings, earwigs, etc. to be eventually sent to respective experts in the field.

Literature (Moths of Borneo series) was received and other equipment purchased (microscopes, etc.).

Both stations were given up in November 2007, when moth activity nearly ended in Gagar and had already been surveyed the previous year in Ranibagh.

RESULTS

Firstly, I was able to satisfy my long-standing curiosity about the altitudinal distribution of many species found in the area.

Sorting out and identifying the moths yielded roughly 890 species, with circa 161 new species records and many new generic records for the area, of moths that had previously either been recorded from eastwards (Sikkim, Nepal) or westwards (Himachal Pradesh, Garhwal) of the Kumaon Himalaya. Species that had been previously recorded from both east and west of Kumaon, or whose distribution was stated to be "throughout India" but had not been reported from Kumaon proper were not considered as new records. In addition, roughly 350 species await identification and there are perhaps a dozen undescribed species among them. Once these moths are identified, the number of new records will certainly increase.

At least two species were "re-discovered" after almost a century. The examination of a third species, of which one individual appeared, has clarified that a new genus will have to be erected for it.

The list of moths will be published in the March 2008 issue of the scientific journal Bionotes. In the meantime, I have approached the (governmental) Biodiversity Board of Uttarakhand for the possible production of a book called "Moths of Nainital district" which would include the material collected under the present project. The proposal is under consideration. If I can find a publisher for such a book, whether the Biodiversity Board or private, then all the findings will be published in that book, including new species, seasonality, ecological preferences, etc.

Many moths were bred in the course of the project and several new larval hostplants were discovered. These findings will be published in due course.

The experiment about attracting moths to different types of fruit bait did not provide any publishable results.

A few dozen moths were donated to the Entomological Collection at the Forest Research Institute, Dehra Dun, mostly species lacking in that collection. More specimens will be donated in due course. The generous help of experts at the Natural History Museum, London, has been sought to confirm whether some moths are actually undescribed species. If they are indeed undescribed, then they will be named and described in reputed scientific journals.

The mantids have been sent to Modern College, Pune, Maharashtra, where they will be identified. If anything noteworthy is discovered, the findings will be published in a scientific journal.

I have as yet not found an Indian expert for the longhorn beetles (Cerambycidae), so they are with me, as are the stag beetles (Lucanidae) and sundry other insects collected during the project.

During the course of the project, I was invited to lecture middle-rung Uttarakhand State Forest Department field staff on biodiversity at the Forest Research Institute, Haldwani. The point about ecosystem health and groundwater stability was well received, so a small beginning was made about sensitizing concerned authorities about the need to replace ecosystems rather than random regreening.

HOW THE MONEY WAS USED

Most of the funds were used as intended, such as the salaries; literature; travel; internet charges. The contingency funds were used to make more cabinets than originally intended (50 cabinets instead of 20), for additional literature (Rs.12000/- instead of the budgeted Rs.10000/- for Moths of Borneo), for membership for me and Rajani Smetacek in the Lepidopterists' Society (US\$40/- + US\$10/-), for page charges for a paper published in the Journal of the Lepidopterists' Society 60(2):82-85 (US\$40/-) and the remainder is being held for page charges for publishing the results of this project (Rs.2500/- for the list of moths in Bionotes), as well as page charges for descriptions of new species and other findings in reputed journals if the book called Moths of Nainital does not work out.

The Rufford Small Grants Foundation's support will be acknowledged and copies of all scientific publications based on results emerging from data obtained under this project will be forwarded to you as and when they are published. Bionotes publishes quickly, but other journals take from a few months to a few years to publish a paper after it is accepted.

## CONCLUSION

The Lepidopteran diversity of the project area has turned out to be much richer than previously estimated, with roughly 18% added to the moth fauna. This percentage will doubtless increase once the remaining 350 species are identified.

Initial estimates indicate that the sal (Shorea robusta) forest in Ranibagh (400m elevation) supports a smaller variety of moths than Bhimtal (1500m), with many species common to both locations. The Gagar (2400m) fauna, representing high elevation banj oak (Quercus leucotrichophora) and tilonj (Quercus floribunda) forest is rather different, with singletons of some common species having been recorded from Bhimtal over the years and many species not occurring in Bhimtal even as stragglers; a very small percentile of the Gagar fauna is also found in Ranibagh. Many species of moths, especially the rarer ones, have so far been recorded only from Bhimtal, so there is a possibility that these are restricted to the low elevation oak forest or else Miscellaneous Deciduous forest found above Ranibagh and below Bhimtal, between 500 and 1400 m.

The results strongly suggest that Himalayan oak forest between 1200 to 1600 m elevation supports a different insect fauna compared with that between 1600 m and above. From a conservation point of view, this is an important finding, since not only is oak forest the most persecuted biotype but there are very few examples of good oak forest remaining between 1200 m and 1600 m.

From a scientific point of view, this is extremely interesting, since botanically there is little difference between oak forest plant communities at higher and lower elevation. If these two support different insect communities, then biodiversity conservation, which is largely either plant-community based (Nanda Devi Biosphere Reserve, Valley of Flowers National Park, etc.) or else based on keystone or especially endangered organisms (Himalayan Newt Sanctuary), will have to take into consideration that similar plant communities may support quite different insect communities. However, further confirmatory studies are required before this can be convincingly presented.

Many species of fruit piercing moths (some groups belonging to the Catocalinae) were found throughout the study area. Although there are many orchards in this area, the area around Gagar being famous for apples and stone fruit, the damage done by these species has not been assessed so far, perhaps due to the lack on information available on this subject.