

## Uphill journey of plants in the Himalaya

This refers to a recent article<sup>1</sup> about *Soliva anthemifolia* (Juss.) R.Br. ex Less. (Asteraceae). In the mountains upward migration of plants is usually linked with global warming, as has been done by the authors<sup>1</sup> after their critical observations, thus adding another evidence of the uphill journey of plants in the Himalaya.

I would like to add further information regarding distribution of this species in western Himalaya. *S. anthemifolia* also occurs as a weed in wheat or rice fields in western Himalaya and in many parts of the world<sup>2</sup>. In fact, the present author has collected it from a wheat field of Bhimtal (near Naini Tal), Uttarakhand at an altitude of 1315 m on 21 March 2010. But much before this collection, the species was reported from Gopeshwar in the flora of Chamoli District<sup>3</sup> in 1984. The locality mentioned in the flora lies at 1393 m, though the authors<sup>1</sup> claimed its highest altitudinal distribution up to 1300 m in the Himalaya. Both of these pinpointed localities (wheat field at Bhimtal and PG College campus at Gopeshwar) are adjacent to roads and road traffic may have its role in disseminating the seeds here.

*S. anthemifolia* is a non-indigenous (alien) species in India, having a short history of less than 50 years, and thus it is still spreading to the areas where it can thrive or survive. It is possible that due to relatively recent introduction (as compared to native species of the area), its range of altitudinal distribution may not have stabilized. Considering its occurrence at 1393 m in 1984 and unknown/unstabilized altitudinal range, the upward migration may simply indicate invasion of yet another adjacent area. In the cooler climate of New Zealand and China, this species has established itself successfully and is now mentioned as an invasive alien<sup>4,5</sup>. Therefore, not only the vertical, but the horizontal spread of this neotropical element is alarming (it has spread in the entire northern India within the last five decades), particularly in the cool mountain climate where it may become invasive alien species replacing native flora.

Occurrence of lowland plants at higher altitude may be linked with successful dispersal of diaspores or vegetative propagules from low altitudes, noticed in the case of *Silene conoidea* L. (Caryo-

phyllaceae) and *Anagalis arvensis* L. (Primulaceae). These species have also been noticed above 3500 m near Kedarnath and on the way to Hemkund in Garhwal Himalaya. Upper altitudinal limits of these species usually do not reach beyond 2000 m in this part of the Himalaya. Therefore, their occurrence above 3500 m is striking. However, critical observation revealed that their seeds reached here with horses/mules and germinated successfully. Both of these species are winter annuals at low altitude and find comparable temperature range in summer season at high altitudes. Thus they germinate and complete their life cycle. However, usually seeds are not produced, and hence the populations are not stable.

In the Himalaya upward shift in *Pinus wallichiana*<sup>6</sup> (a tree-line ecotone species) and *Soliva anthemifolia*<sup>1</sup> (a new alien species) in Himachal Pradesh; in the entire timberline in Nanda Devi Biosphere Reserve, Uttarakhand<sup>7</sup> and colonization of areas vacated by receding glaciers and ice sheet (Figure 1) from the

Valley of Flowers<sup>8</sup>, Uttarakhand, have been recently reported, indicating serious impact of global warming on the Himalayan ecosystem. However, the study reporting upward shift of timberline in Nanda Devi Biosphere Reserve has also been criticized for its inappropriate methodology<sup>9</sup>. It is evident that when global and regional climatic conditions are changed, plants shift their habitat to optimum adaptive elevation from conventional altitudes<sup>10</sup>. The effect of rising temperature (like ecosystem boundary shift) in the mountains worldwide is well known and documented, but in the Himalayan context it is little or less reliably studied (in some cases) due to which scientific uncertainties still prevail regarding its cascading effects<sup>11</sup>.

Due to lack of exact and reliable past altitudinal ranges of native floral species (and certainly not of alien species/recent introductions) or ecosystems existing in the Himalaya for the last several thousands years with their stabilized altitudinal ranges, quantification of altitudinal shift due to global warming is difficult



**Figure 1.** A view of the high Himalayan valley. Tongue-like debris mass in the area was vacated by a glacier which is gradually being invaded by alpine herbs. Similarly, areas vacated by ice sheet are being colonized by upward-migrating plants. Glaciers and permanent ice sheets in the Himalaya are receding at an alarming rate due to global warming, thus opening higher and new habitats for colonization by plants.

and scarcely documented. Therefore, this lack of scientific data urgently warrants further research using appropriate taxa, reliable techniques and on-the-spot field studies in entire Himalayan range to understand the impact of climate change, its cascading effects and possible ways to mitigate it.

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## Is diclofenac the only culprit for declining population of *Gyps* vultures in the Moyar Valley

The widely distributed vulture population of India is currently restricted to a few localities<sup>1</sup>. It is now rather well-recognized that vultures, especially those belonging to the genus *Gyps*, are facing a radical population decline for about a decade (95%) in South Asia<sup>2–5</sup>. The population decline of *Gyps* was first noticed in the mid-1990s in Keoladeo National Park, Rajasthan, where the number of breeding vultures was found to be less than half compared to the earlier decade. By 1999–2000, there were no vultures left within the Park<sup>6</sup>. The reason for population decline of the *Gyps* vultures in the Indian subcontinent is believed to be due to the non-steroidal anti-inflammatory drug, diclofenac used in veterinary practice for treating cattle<sup>7,8</sup>. It is also believed that apart from diclofenac, other drugs used in veterinary practice such as carprofen, flunixin, phenylbutazone and ibuprofen may also be toxic to vultures and other scavenging birds<sup>9–11</sup>.

While this trend seems to be typical to the Indian subcontinent, our ongoing work in the Moyar Valley, Sathyamangalam Forest Division, Tamil Nadu, provides a glimmer of hope. The Moyar Valley has a resident population of four species of vultures, viz. Egyptian Vulture (*Neophron percnopterus*), King Vulture

(*Sarcogyps calvus*), White-rumped or White-backed Vulture (*Gyps bengalensis*) and Long-billed Vulture (*Gyps indicus*) in reasonable numbers. It is also rather interesting to note that the Valley has a significant presence of cattle, given the rather pastoral nature of the local human population, wherein the practice of treating the cattle with diclofenac is not prevalent.

To understand the trend in greater detail, a survey on the population of vul-

tures was carried out recently, wherein about 161 km of transects were laid and sampled. In certain cases, existing game roads were used as transect lines. Population estimation based on encounter rates was in accordance with the methodology detailed in the literature<sup>6,12</sup>. Assessment of food availability was through the enumeration and analysis of carcasses. Additional secondary data were gleaned from the historical records of the Tamil Nadu Forest Department.

