to determine the age of a particular activity as it has uniform growth rate.

The glacier stages 1–3. It appears that Achenbach has not noticed the glacial landforms particularly the moraines. Continuity of L1 on both sides of the glacier around the snout still exists. Then how they can be of neoglacial age? Moreover L2, L3 and L4 are present within the loop of lateral and terminal moraine of L1.

OSL dating. There are various limitations in sampling techniques for OSL. In their paper, SK4, SK5 and SK6 are the sample sites from the same moraine, deposited at the same time, and showing the age difference 9.9 ± 1.8 (10.1 ± 1.5 ka), 9.3 ± 1.8 and 1.1 ± 0.2 ka respectively. Even in these ages, ± 1.8 ka means an uncertainty factor of 3.6 ka years. Besides, SK9 and ABU147 are the same samples analysed in two different labs and the results are 21.9 ± 3.0 and 20.5 ± 1.4 ka years respectively. Radiocarbon dates, also referred to in the paper, from moraines close to modern glaciers in the Khumbu Himalayas are 480 ± 80 (Muller), 550 ± 85 (Benedict) and 410 ± 100 (Fushimi). If an older slide material in the area is transported and deposited by the glacier as one of its landforms, and a sample taken from that will give a misleading age.

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RAVINDER KUMAR CHAUJAR

Wadia Institute of Himalayan Geology, Dehra Dun 248 001, India
e-mail: rchaujar@gmail.com

From ornamental to detrimental: plant invasion of *Leucanthemum vulgare* Lam. (Ox-eye Daisy) in Kashmir valley, India

In the contemporary world, biological invasions represent a major contributory factor to the global biodiversity crisis[1,2]. In fact, the theme of the International Day of Biological Diversity, 2009 was 'invasive alien species' in an effort to raise awareness and focus attention on this grave but hitherto least appreciated threat to biodiversity[3].

Since the historical past, humans have been introducing alien plant species from other biogeographic regions of the world for food, fodder, fibre, fuel, etc. However, the number of such introductions during recent times, particularly for ornamental purposes, has increased manifold. Such introductions are either intentional or unintentional. Majority of the alien introduced species are benign, however some of these species escape from cultivation, spread slowly and silently at initial stage, but become dominant and widespread at later stages to attain an invasive status in the introduced range and prove detrimental for the native biodiversity[4]. Many studies[5–8] have shown that trade in ornamental species, in particular, represents one of the most important pathways of introduction of invasive species. Several of these species are presently ranked among the world's 100 worst weeds, e.g. *Lantana camara*. About half of the 300 most invasive plants in North America, and more than 70% of the New Zealand's invasive weeds, were intentionally introduced to gardens and parks as ornamental plants[9].

Kashmir valley, nestled in the northwestern extremity of Himalayan biodiversity hotspot, is bestowed with an incredible plant wealth[10]. However, over the last few decades, flora of the valley faces a multitude of threats. Being historically a global tourist destination, the valley has witnessed intentional introductions of several alien species for ornamental purposes, particularly in the public gardens, private parks and tourist spots[11]. One such ornamental species with European origin[12] has been *Leucanthemum vulgare* (Ox-eye Daisy), which was introduced in Kashmir during the British era for its beautiful white blooms. However, our field observations and continuous monitoring of alien plant species over a decade have indicated that this species has escaped from cultivation and is now growing profusely in the wild. Presently, it shows restricted distribution in the peripheries of tourist spots such as Gulmarg, Tangmarg, Pahalgam and Duksum, and gardens such as Harwan, Shalimar and Kashmir University Botanical Garden. At these sites, it grows abundantly in the forest openings (Figure 1), meadows, public lands, and along the periphery of wetlands and degraded slopes of roadsides.

L. vulgare is a perennial herb. Belonging to the family Asteraceae, it bears white ray florets and yellow disc florets. Though primarily cultivated in the areas of aesthetic importance but with each passing year, the species is expanding its geographical extent much away from the source populations and increasing its population abundance to form pure stands. Its seeds have efficient mechanism of dispersal by wind, and potential to spread throughout the sub-alpine and alpine landscape of the region. Because species is not grazed by domestic livestock and/or wild animals, it is a serious threat to the sustainable use of alpine pastures in the region which sustain huge livestock population. Road construction and other developmental activities create forest gaps and disturbed habitats in alpine meadows that provide ideal sites for the species to form monospecific stands thereby drastically reducing the occurrence and abundance of native diversity.

As a part of the present study, we did field sampling studies in the coniferous forests dominated by *Pinus wallichaina* (Blue Pine) at Gulmarg (2600 m amsl) during 2009. The sampling unit used was 1 m^2 quadrat. We selected three different sites for sampling: (i) Highly invaded site, where the visual cover percentage of *L. vulgare* was more than 70; (ii) Moderately invaded site, where the visual cover percentage of *L. vulgare* was less than 50, and (iii) Un-invaded site, where there was no invasion of *L. vulgare*. At each site, 10 quadrats were laid down randomly.

Figure 1. A Conifer forest-opening invaded by *Leucanthemum vulgare* at Gulmarg, Kashmir valley, India.

Table 1. Comparison of species density in the highly invaded, moderately invaded and un-invaded sites in Kashmir valley, India (quadrat size: 1 m^2)

Species composition	Highly invaded site	Moderately invaded site	Un-invaded site
Leucanthemum vulgare Lam.	34.2	28.6	–
Trifolium repens L.	3.0	6.2	1.2
Fragaria nubicola Lindl.	0.8	–	4.4
Cynodon dactylon Pers.	1.3	102.0	–
Prunella vulgaris L.	0.6	2.2	0.8
Sambucus wightiana Wall. ex Wt. & Arn.	1.2	–	–
Trifolium pratense L.	1.2	4.2	3.2
Achillea millefolium L.	–	6.8	–
Bothriochloa ischaemum Keng.	–	3.2	–
Rumex nepalensis Spreng.	–	1.8	2.0
Rumex hastatus D. Don	–	0.2	1.2
Viola odorata L.	–	0.2	1.6
Geranium nepalense Sweet	–	1.8	2.4
Taraxacum officinale Weber	–	–	1.4
Polygonum amplexicaule D. Don	–	–	1.4
Plantago lanceolata L.	–	–	1.8
Plantago major L.	–	–	0.8
Chenopodium foliosum Asch.	–	–	1.6
Cichorium intybus L.	–	–	2.0
Oxalis acetosella L.	–	–	0.8
Potentilla reptans L.	–	–	2.6
Oxytropis mollis Royle ex Bth.	–	–	1.2
Poa bulbosa L.	–	–	2.0
Bromus japonicus Thunb.	–	–	1.8
Stellaria media L.	–	–	1.4

Table 2. Measures of species diversity and species evenness in the highly invaded, moderately invaded and un-invaded sites in Kashmir valley, India

Sampling sites	Species diversity (*H*)*	Species evenness (*J*)*
Highly invaded site	0.83	0.12
Moderately invaded site	1.21	0.11
Un-invaded site	2.82	0.94

*Magurran[13].

Species composition was noted down and species density was used for computation of the species diversity and evenness measures[13]. Results reveal that the species richness shows a decreasing trend 20, 11 and 7 in the un-invaded, moderately invaded and highly invaded sites respectively (Table 1). Similar trend was observed for the species diversity. The values of species diversity decrease from 2.82, 1.21 and 0.83 in the un-invaded, moderately invaded and highly invaded sites respectively. With reference to species evenness, both the moderately and highly invaded sites show significantly lower values, and have nearly similar values of 0.11 and 0.12 respectively. However, in case of the un-invaded site, value of species evenness was appreciably higher, i.e. 0.94 (Table 2). The decline of the species diversity in the *L. vulgare* invaded sites has serious implications for the native biodiversity and ecosystem functioning. More importantly, *L. vulgare* domination of the forest landscape homogenize the species composition of the community as revealed by lower values of species evenness in the invaded sites. By this way, the monocultures of invading species lead to extirpation of the native rare species.

Our preliminary field observations also indicate its potential inhibitory role in retarding the natural regeneration of the seedlings of other species in the forest ground floor that need to be further investigated. Even in the plantation programmes run by the State Forest Department, the species is hampering the growth of planted seedlings. On account of its eradication, the department has to incur huge labour costs. By its invasion of the meadows, it can completely transform the natural landscape of the tourist spots, thereby putting at stake the livelihood of the local population in the region. Pertinently, the Ox-eye Daisy has been already designated as an obnoxious weed in North America. Elsewhere, the species has also been reported to serve as a host and reservoir for several species of polyphagous gall-forming *Meloidogyne* nematodes that feed on crops[14].

In this backdrop, *L. vulgare* is presently restricted to the peripheries of only tourist spots and public gardens in the Kashmir valley. It is at this stage of its invasion when management strategy in the form of eradication can meet success. Otherwise, if we fail to act this time, it is near-impossible to stop its invasion all across

the alpine montane ecosystems of the Himalaya[15].

The sordid saga of *Lantana camara* in India has been scientifically well-researched[16]. It took us more than two centuries to recognize the invasiveness of this species. This species introduced for ornamental purpose from South America has now invaded almost the whole country, particularly natural forests. Presently, all our curative management strategies fail to stop, or least retard, its further proliferation into the natural landscapes. In this case, and in other species as well, the main reason behind our failure to control the spread of invasive alien species is due to the lack of early warning system during the initial stages of invasion when the species has formed few wild populations by escaping near the site of cultivation. Our past bitter experience of acting too late has made us to incur huge economic and ecological losses on account of such biological invasions. And in most cases, we are still battling to stem the surge of invasive alien species.

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ANZAR A. KHUROO[1,*]
AKHTAR H. MALIK[1]
ZAFAR A. RESHI[2]
G. H. DAR[1]

[1]*Centre for Plant Taxonomy, Department of Botany, University of Kashmir, Srinagar 190 006, India*
[2]*Biological Invasions Laboratory, Department of Botany, University of Kashmir, Srinagar 190 006, India*
**e-mail: anzarak@gmail.com*

Ensete superbum (Roxb.) Cheesman: a rare medicinal plant in urgent need of conservation

Genus *Ensete*, a native of tropical regions of Africa and Asia comprises nine species. Out of these, *Ensete superbum* (Figure 1 *a*) and *Ensete glaucum* are found in India. The former, commonly known as cliff banana, belongs to the family Musaceae. Although reported endemic to the Western Ghats[1], India, it is also found in Assam and Rajasthan sporadically. The plant is known as '*kalluvazha*' in Kerala, '*kalvazhai*' in Tamil Nadu, '*kallubale*' in Karnataka, '*rankeli*' in Maharashtra and '*junglikela*' in Gujarat.

Therapeutic potential of the seeds of cliff banana for various human ailments, viz. diabetes, leucorrhoea, kidney stone, dysuria[2], etc. has been reported. Indigenous communities consume fruits, flowers and pseudostem as vegetable. Non-steroidal phytosterol (4-hydroxy-3-methyl-hex-5-enyl)[3], isolated from seeds of *E. superbum* is used variously as medicine and food additives. Seeds of *E. superbum*, a commodity of indigenous trade with a market price[4] ranging from Rs 200 to 400 per kg across various states, are an established non-wood forest produce[5]. It is a preferred ornamental species of landscape horticulturists. Characteristic phyllotaxy on a large pseudostem gives the plant a huge nested-fern appearance and enhances its aesthetic value. The beauty of the inflorescence in the opening and later stages is captured in Figure 1 *b* and *c*.

Unlike members of the Musaceae family, *E. superbum* does not produce any suckers and is non-stoloniferous. Hence regeneration by seeds (Figure 1 *d*) is the only means of natural multiplication. Our survey in its natural habitat in Gujarat (Pavagadh, Dangs), Maharashtra (Veer, Raigad), Karnataka (Siddapur, Kargal) and Kerala (Ponmudi, Vithura and Kulathupuzha) showed excessive habitat degradation. Indiscriminate harvesting for commercial gains, grazing and destruction of immature fruits by elephants and monkeys have drastically reduced the population in the surveyed sites. This is an issue of serious concern since the species is already listed as rare[6,7], endangered[5], conservation concern[8,9], overgrazing and destruction by *Semnopithecus entellus* (Hanuman langurs)[10].

Considering the present status, urgent efforts are needed to conserve its population in its natural habitat. The Task Force on conservation and sustainable use of medicinal plants, has recommended sev-