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Biological invasion, biodiversity and people

All the species on earth are interrelated. Till date approximately 1.75 million different species have been identified. This includes 270,000 plants species, 950,000 insect species, 9,000 species of birds, 19,000 species of fish, and 4,000 mammal species. And it is believed that, this is only a small fraction of the total biodiversity present on earth. There are millions more species which are yet to be discovered. Ecosystems with rich biodiversity are considered to be healthy, strong and highly resistant (Bargali *et al.*, 1993; Sharma *et al.*, 2005; Khatri, 2023). However, the current world is facing a suite of vital challenges including climate change, biodiversity loss, environmental pollution, food scarcity etc. The nature is vanishing at an unprecedented rate due to climate change as nature and climate are intertwined (Poudel *et al.*, 2019). With the present climate change scenario, a number of other menaces have also emerged which are threatening the biodiversity and deteriorating the environmental health (Bargali, 1996). Biological invasion is one among the major forces of change, influencing many dimensions of life on earth (Pathak *et al.*, 2019; Khatri *et al*., 2022a). Invasion results when species cut off from existing populations and inhabit novel geographical areas via outcompeting the native flora and fauna (Khatri *et al.*, 2022b). Humans are solely responsible for the rapid spread of invasive species all over the world as globalization and intercontinental transportation have dramatically altered invasion dynamics (Rai and Singh, 2021; Khatri *et al*., 2023a). There are compelling evidences that invasive species pose remarkable harm to native biodiversity all over the world (Negi *et al*., 2023a). The magnitude of these threats is increasing day by day as the other factors which are also responsible for biodiversity loss including global warming, habitat loss, environmental pollution etc. are promoting biological invasion (Khatri *et al*., 2023b). It is believed that climate warming could exacerbate the invasion risks as invasive species are reported to perform better and adapt to the rising temperature conditions as compared to native species (Khatri *et al*., 2023c). However, invasion by exotic species is the most challenging conservation riddle of our time. Invasive species have the potential to rapidly proliferate and spread in the novel environmental conditions of the recipient areas. These species expand and grow explosively and alter ecological characteristics such as fire regimes, nutrient cycling, hydrology, energy budgets, and evolutionary trajectory in a native ecosystem, making places less habitable for native species. These species can also change the species composition and structure of the community, break the ecosystem balance and pose a considerable threat to conservation and economy. Biological invasion is the primary cause of more than 20% of the total species extinctions globally and is considered the major driver of species extermination and biodiversity loss. The recent increase of invasive species in mountains is of particular concern due to the ecosystem services these regions provide, and the role they play in preserving biodiversity

With the increasing risks of biological invasion, researches are being carried out all over the world on various aspects of invasion including:

(i) Identification of mechanisms responsible for invasion success of alien species.
(ii) Impacts posed by these invasive species on biodiversity and ecosystem services.
(iii) Management interventions of invasive species.

Studies have been performed to eradicate the invasives via physical, chemical as well as biological means. However, till date no valid records are available for successful management of invasive species from all over the world via any of these methods. The reason for the failure of these attempts could be the multiple strategies adopted by these species for their invasion success (Fig. 1) and requirements of comparatively larger amount of funds to eradicate these invasives from all over the world.

Economic costs of biological invasions worldwide: Biological invasions are responsible for terrific impacts globally, including huge economic losses and mitigation expanses. Diagne *et al.* (2020) prepared "the InvaCost database" to describe these impacts in terms of economic costs to raise public awareness, and induce policy makers for the better management plans. In the view of Diagne *et al.* (2021), the total reported cost of biological invasion reached upto 1.288 trillion US dollars from 1970–2017 with the annual cost of US$26.8 billions. Pimentel *et al.* (2001) reported that in India the invasion cost is comparatively high

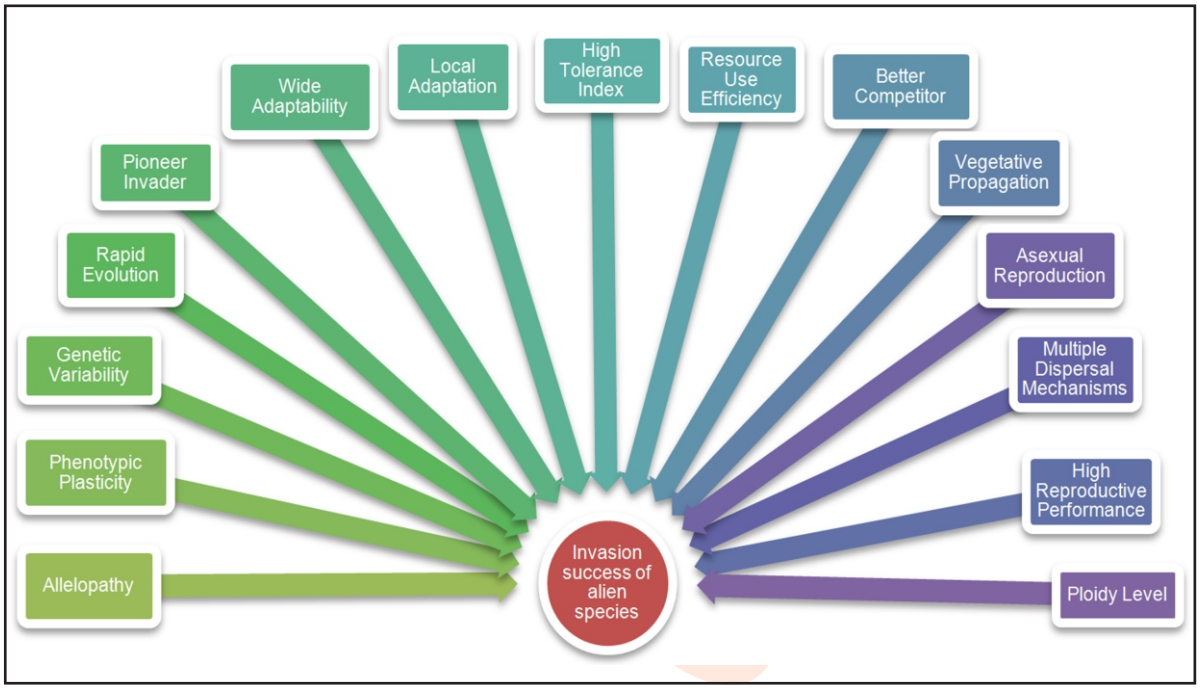

Fig. 1: Factors contributing to the invasion success of alien plants.

which is ~30% and amounts 37.8 billion US dollors per year. Presently, invasion ecology is evolving via defining impacts and characterizing invasion risks (Jhariya *et al*., 2022). In the context of India, a number of exotic species have been reported to successfully establish and invade a wide range of areas (Khatri *et al*., 2022c). Among the alien species, *Lantana camara* (Wild sage), *Ageratina adenophora* (Crofton weed), *Parthenium hysteroporus* (Congress grass), *Ageratum conyziodes* (Chick weed), *Prosopis juliflora* (Mesquite), *Achatina fulica* (Giant African Land Snail), *Oreochromis mossambicus* (Mozambique Tilapia fish), *Clarias gariepinus* (African catfish), *Kappaphycus alvarezii* (Seaweed) etc., are some of the highly noxious invasive species which are proliferating in India. Irrespective of the huge ecological and economic losses caused by these invasive species, limited researches have been performed to study their impacts on native biodiversity and environmental health in addition to their management plans from the Indian context (Khatri *et al*., 2023 c&d; Negi *et al*., 2023b). These species are not only threatening the native biodiversity, but are also harming food security via reducing agricultural productivity, economy, ecosystem services and water, soil and air qualities (Joshi *et al*., 1997). Therefore, it is the urgent need of time to carry out studies on diverse facets of biological invasion as:

- Prediction and rank potential of invasive species.
- To identify susceptibility and vulnerability of different ecosystems to biological invasion.
- To develop strategies for the management and eradication of invasive species.
- To reinforce biodiversity conservation policies and sustainable use of biodiversity.
- To emphasize the bio-security procedures ahead of established national border interventions.

The Global Invasive Alien Species Indicator revealed that there has not been significant reduction in the biodiversity due to biological invasion yet. Hence, timely implementation of proper and effective management plans could possibly conserve the existing biodiversity and protect the nature from further harmful impacts of biological invasion. In my opinion, nature based solutions like restoration of degraded lands, afforestation and reforestation, promotion of native species and various other biodiversity conservation methods need to play the key role for mitigation of biological invasion. Furthermore, exploitation of the invasive species could be an alternative to eradicate some of the invaders like plant species. In our studies, it was seen that utilization of larger quantity of biomass (prior to reproductive phase) produced by invasive plant *A. adenophora* in the form of compost and biochar for growth and productivity enhancement of native tree and crop species as well as for soil health improvement could be an appropriate and feasible method to mitigate the food scarcity issues, growth enhancement of native vegetation, and protection of biodiversity (Khatri *et al*., 2023c). Invasive plant species are reported to be highly allelopathic in nature (Khatri *et al.,* 2020; Negi *et al*., 2020). Hence, exploring the potential of

allelopathy by invasive plants could also be promising in achieving higher crop productivity without compromising the environmental safety due to use of chemical fertilizers and pesticides. Invasive plants can be effective bio-herbicides that could be used as the potential alternative weed control options by replacing synthetic herbicides to minimize the environmental pollution caused by these synthetic herbicides and increase crop production.

Whilst, the state, national and international communities have been implementing various events, programs and campaigns to create awareness among people about nature's health, our responsibilities towards protecting environment and consequences of various anthropogenic disturbances in upcoming future, such awareness are limited only to specific events only. Environment day, Earth day, Wildlife day, Forest day, Water day etc., are some of such examples. This year in 2023 also, these days were celebrated with full participation of students, people, and researchers at global scale. However, all these participations, plantation drives, cleanliness campaigns and awareness programs have been seen to be limited to these particular days, events or dates only. Before and after these occasions, no such actions are taken by any of the local, governmental or non-governmental bodies and progresses are only limited in the paper works. Hence, if there will be an active participation of locals, researchers and governmental organizations for the conservation of nature, not only the issue of biological invasion, but other global issues like global warming, pollution, biodiversity loss, food and water insecurity, deforestation etc., can be conquered. The foremost need is that humans have to learn to value the nature, and understand that if they have the rights over nature, they also have duties regarding nature. So they will not merely exploit the environment but also realize their duties and concerns towards the healthy earth needed for human welfare. Only then the sustainable development goals can be achieved.

Efforts being made by *Journal of Environmental Biology* for promoting and encouraging studies concerning environmental health and sustainable development deserve profound gratitude. It is my proud privilege to express, in brief, my association with *Journal of Environmental Biology* for last 10 years as the member of its Editorial Board, research advisor and reviewer. The journal has been promoting the researches in diverse areas of environment and is solely interested in nature's health and conservation efforts. I fondly cherish my association with Dr. Sumati Gaumat, Editor of *Journal of Environmental Biology*. Her devotion and efforts to increase the journal's standards and reputation, in addition to publication of quality research is highly appreciated.

References

Bargali, S.S., R.P. Singh and M. Joshi: Changes in soil characteristics in eucalypt plantations replacing natural broad ‐ leaved forests. *J. Veg. Sci.*, **4**, 25-28 (1993).

Bargali, S.S.: Weight loss and nitrogen release in decomposing wood litter in an age series of eucalypt plantation. *Soil Biol. Biochem*., **28**, 699-702 (1996).

Diagne, C., B. Leroy, A.C. Vaissiere, R.E. Gozlan, D. Roiz, I. Jaric, J.M. Salles, C.J. Bradshaw and F. Courchamp: High and rising economic costs of biological invasions worldwide, *Nature*, **592**, 571–576 (2021).

Diagne, C., B. Leroy, R.E. Gozlan, A.C. Vaissiere, C. Assailly, L. Nuninger, D. Roiz, F. Jourdain, I. Jaric and F. Courchamp: InvaCost, a public database of the economic costs of biological invasions worldwide. *Sci. Data*, **7**, 1–12 (2020).

Jhariya, M.K., A. Banerjee, A. Raj, R.S. Meena, N. Khan, S. Kumar and S.S. Bargali: Species invasion and ecological risk. In: Natural Resources Conservation and Advances for Sustainability. *Elsevier*, pp. 503-531 (2022).

Joshi, M., K. Bargali and S.S. Bargali: Changes in physico- chemical properties and metabolic activity of soil in popular plantations replacing natural broad leaved forests. *J. Arid Environ.*, **35**, 161-169 (1997).

Khatri, K., B. Negi, K. Bargali and S.S.Bargali: Effects of different concentrations of leaf residues of *Ageratina adenophora* on seed germination and growth behavior of two native tree species of Kumaun Himalaya, India. *Waste Biomass Valori.,* (2023c). https://doi.org/10.1007/s12649-023-02213-5

Khatri, K., B. Negi, K. Bargali and S.S.Bargali: Effects of elevation and habitat on leaf and reproductive traits of *Ageratina adenophora* (Sprengel) King & Robinson. *S. Afr. J. Bot.*, **147**, 859–870 (2022a).

Khatri, K., B. Negi, K. Bargali and S.S.Bargali: Phenotypic variation in morphology and associated functional traits in *Ageratina adenophora* along an altitudinal gradient in Kumaun Himalaya. *India, Biologia*, **78**, 1333–1347 (2023a).

Khatri, K., B. Negi, K. Bargali and S.S.Bargali: Spatial variation in allelopathic inhibition by *Ageratina adenophora* on growth and yield of two traditional millet crops. *Vegetos,* **35**, 663–673 (2022c).https://doi.org/10.1007/s42535-022-00353-y

Khatri, K., B. Negi, K. Bargali and S.S.Bargali: Trait plasticity: a key attribute in the invasion success of *Ageratina adenophora* in different forest types of Kumaun Himalaya, India. *Environ. Dev. Sustain.*,(2023d).https://doi.org/10.1007/s10668-023-03529-x

Khatri, K., B. Negi, K. Bargali and S.S.Bargali: Trait variability in co-occurring invasive and native plant species in road side population of Kumaun Himalaya. *Braz. J. Bot.,* **45**, 1099–1110 (2022b).

Khatri, K., K. Bargali, B. Negi and S.S. Bargali: Germination and early seedling growth of two rice varieties as affected by invasive *Ageratina*

adenophora. *Curr. Agric. Res. J.*, **8**, 108–117 (2020).

Khatri, K., K. Bargali, S.S. Bargali and B. Negi: Effects of leaf residues from *Ageratina adenophora* on germination, growth and productivity of two rabi crops. *Acta Ecol. Sin.,* **43**, 363–374 (2023b).

Khatri, K.: Phenotypic plasticity and allelopathic potential of *Ageratina adenophora* (Spreng.) King & Robinson in different habitats of Kumaun Himalaya, Ph.D. Thesis, Kumaun University, Nainital, (2023).

Negi, B., K. Khatri, S.S. Bargali and K. Bargali: Invasive *Ageratina adenophora* (Asteraceae) in agroecosystems of Kumaun Himalaya, India: A threat to plant diversity and sustainable crop yield. *Sustainability*,**15**, 10748 (2023a).

Negi, B., K. Khatri, S.S. Bargali, K. Bargali, A. Fartyal and R.K. Chaturvedi: Impact of invasive Ageratina adenophora on relative performance of woody vegetation in different forest ecosystems of Kumaun Himalaya, India. *J. Mt. Sci.* (2023b). https://doi.org/10.1007s11629-022-7862-z

Negi, B., S.S. Bargali, K. Bargali and K. Khatri: Allelopathic interference of *Ageratum conyzoides* L. against rice varieties. *Curr. Agric. Res. J.*, **8**, 69–76 (2020).

Pathak, R., V.S. Negi, R.S. Rawal and I.D. Bhatt: Alien plant invasion in the Indian Himalayan Region: state of knowledge and research priorities. *Biodivers. Conserv.*, **28**, 3073–3102 (2019).

Pimentel, D., S. McNair, J. Janecka, J. Wightman, C. Simmonds, C. O'connell, E. Wong, L. Russel, J. Zern, T. Aquino and T. Tsomondo: Economic and environmental threats of alien plant, animal, and microbe invasions. *Agric. Ecosyst. Environ.*, **84**, 1–20 (2001).

Poudel, A.S., P.K. Jha, B.B. Shrestha and R. Muniappan: Biology and management of the invasive weed *Ageratina adenophora* (Asteraceae): current state of knowledge and future research needs. *Weed Res.*, **59**, 79–92 (2019).

Rai, P.K. and J.S. Singh: Plant invasion in protected areas, the Indian Himalayan region, and the North East India: progress and prospects. *Proc. Indian National Sci. Acad.*, **87**, 19-35 (2021).

Sharma, G.P., A.S. Raghubanshi and J.S. Singh: Lantana invasion: an overview. *Weed Biol. Manag.*, **5**, 157-165 (2005).

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