



Implications of Climate change on the Phenological strategies and Invasion potential of some alien species of *Amaranthus* in Kashmir Valley

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ABSTRACT

Invasive Alien Species (IAS) and climate change, with land use change and changes in the nitrogen and carbon cycles, are identified as the top four drivers of global biodiversity loss. Phenology, the seasonal timing of life history events, is widely accepted as a sensitive and robust ecological indicator of the impacts of climate change on biodiversity and may play a critical role in invasions. Climate-induced shifts in plant phenology have been linked to the spread of invasive species. Shifts in timing can be related to competition, including resource acquisition and access to pollinators, with species with greater phenological plasticity exhibiting greater resistance to the negative effects of climate change. Climate change impacts on physical and biological systems across the globe like augmentation of growing seasons with both an earlier start in and a later end of the vegetation period in autumn, and phenological shifts (e.g. earlier budburst) have already been reported. During the present study, the phenological behaviour of three alien *Amaranthus* species viz., *Amaranthus blitum* L., *A. caudatus* L. and *A. spinosus* L. was monitored in the natural populations over a period of one year. We investigated the chronological development of these three congeneric species with respect to the initiation and duration of germination, development of spines, initiation of sexual phases, seed development and maturation, senescence and duration of life cycle. Comparison of the phenological events revealed a considerable variability in timing and duration of various phenophases in these species. The difference in the phenological behaviour of these congeneric species is very much important in understanding the differential invasive behaviour of these species as well as for the long term management of these aggressive species in the Kashmir Valley. The breadth of climate change impacts on phenology highlights the potential for phenological data and related information to suggest novel management practices for invasive species like using phenological differences to identify species that may have a high **potential** to be invaders with climate change.

Keywords: *Amaranthus*, *Climate change*, *Invasive*, *Phenology*, *Phenophases*