Natural disjunction: Cedar survives and is well adapted on the trunk of *Picea smithiana*

Maneesh S. Bhandari, Rajendra K. Meena, Brijmohan Rana, Shailesh Pandey and Harish S. Ginwal

The northwestern Himalayan region of India is endowed with rich floral diversity and natural species variation, especially in trees such as fir and spruce. In 2019, forest surveys conducted at Har-ke-Dun valley of Govind National Park (GNP), Uttarakhand, India, revealed an interesting observation of survivability and adaptability of cedar (*Cedrus deodara*, viz. deodar) on *Picea smithiana* which was recorded (Figure 1). Perhaps, the evolutionary and ecological forces describe it as a natural disjunction. The surveyed forest area is on a steep slope (65°) dominated by cedar and *P. smithiana* (geospatial data: lat. 31°05′58.4″; long. 78°17′31.0″ and altitude 2240 m amsl). *Picea smithiana* is a long tree of 20 m height and 0.65 m diameter at breast height (DBH). Interestingly, we observed that erected branch of *C. deodara* emerged from at around 12 m of straight bole of *P. smithiana*, and showed prodigious unity with the stem. Both, droopy leaves of *P. smithiana* and erect needles of cedar were seen on the same trunk with bulge formation near the conjunction.

The reasons for the survival of the cedar on *P. smithiana* are as follows. The cedar cone could have fallen on the damaged trunk of *P. smithiana* and pierced its root deep inside the xylem and phloem for nutrition. The second opinion suggests that cedar seeds were eaten by the birds and the intact seeds that have passed through the intestinal tract were deposited in the faeces may have landed on the trunk and germinated. Another reason is that the side branches of cedar and *P. smithiana*, collapsed with each other, and the wind-driven cone falling over the damaged trunk of *P. smithiana* showed profuse growth. Further, natural forces balanced the accommodation and both species grew adeptly long for light competition. In the temperate regions where sunlight is available only for a short duration, this kind of competitiveness is greater among fir and cone. Although most of the fir trees such as *Abies spectabilis*, *A. pindrow* and *C. deodara*, along the altitudinal gradient competitively acquire greater height and spread profusely with very large side branches, spruce (*Picea*) generally has droopy side branches which cannot bear the load of snowfall; therefore these are damaged, creating gaps on the trunk. Most of the trees display commensalism and parasitic behaviour with algae, fungi, mosses and climbers, which are sources of nutrition and moisture. Under such circumstances, if the newly set seeds fall on the hollow trunk region of *Picea*, the compatibility will definitely help the cedar to grow better and survive. It is a well-known fact that in the forest ecosystem, one species tends to acquire and replace the zone of distribution of other species. For instance, *Pinus roxburghii* penetrates the areas of *Rhododendron arboreum* and *Quercus leucotrichophora*. Similarly, *Pinus wallichiana* shows dominance over *A. pindrow*, *Cupressus torulosa*, *Thuja plicata*, *Rhododendron*

Figure 1. ***a***, Natural disjunction of cedar with *Picea smithiana*. ***b***, Trunk of *P. smithiana*: (i) vertical view and (ii) horizontal view. ***c***, Bulging and conjoint of cedar with *P. smithiana*. ***d***, Spruce leaves and cedar needles emerging from trunk: (i) leaves adhere to the main trunk; (ii) leaf form of spruce and cedar.

campanulatum and *Juniper* sp. Herein, cedar occurrence on *Picea* trunk shows its dominance and checks invasion at its occurrence zone. Evolutionary theories explain the sheer occurrence of many species simultaneously, but the one which fits the ecological conditions survives and is well adapted. Although cedar is dominated by pine, with spruce it shows habitat competitiveness. In such a scenario, during favourable environmental conditions, cedar grows aggressively and is able to germinate on the aged *Picea* trunk. Based on these observations, we highlight the possibility of species selection and evolution in future due to such kinds of natural disjunction, as earlier only chromosomal variations (mutations, selection, genetic drift, etc.) constituted the species evolutionary mechanism. Genetic admixture could be seen in the natural population of species belonging to different geographical and climatic zones, which also confirmed the above mentioned facts. Moreover, the mechanism of phenocopy and natural selection apply to each and every individual of species. Recently, CRISPR-Cas9-based evolutionary mechanism adapted by bacteria against a different kind of phase has been used in molecular phenotyping of individuals. In addition, such phenomenon happened in nature with a coercive pattern of epigenetics. The applications of epigenetics for such kind of disjunction response and adaptation could lead to a better understanding of the regulation of gene expression at transcriptional and post-transcriptional levels, and would have applications in forestry and tree breeding.

It can be concluded that biological complexity of organisms has the potential and capability to extend its limit and endure mutually. The two species (cedar and *Picea*) interact, where the former showed dominance; and its emergence on the side of the main trunk of the latter showed survivability and adaptability perhaps due to natural disjunction.

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Maneesh S. Bhandari, Rajendra K. Meena and Harish S. Ginwal* are in the Division of Genetics and Tree Improvement, Forest Research Institute, Dehradun 248 195, India; Brijmohan Rana is in the Govind National Park, Uttarkashi, Uttarakhand 249 128, India; Shailesh Pandey is in the Forest Pathology Discipline, Division of Forest Protection, Forest Research Institute, Dehradun 248 006, India.*
**e-mail: maneesh31803@gmail.com*
**e-mail: ginwalhs@icfre.org*