

which possess reserpine-like activity strong enough for use in treating hypertension are deserpidine and rescinnamine<sup>5</sup>.

Although *R. serpentina* was used in India for at least five centuries in treating the mentally affected, trial in psychotherapy outside India was carried out only after the discovery of reserpine and demonstration of its therapeutic properties when the powdered whole root was used in the West with moderate success in a wide variety of mental disorders characterized by excitement (mania) rather than depression.

The discovery of reserpine was the first instance of correlation between biological activity and use in traditional medicine in India. According to Lele<sup>6</sup>, there is scope for research on Ayurvedic drugs using current knowledge about molecular pharmacology to substantiate their use by the findings of modern science.

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## Frozen gene bank at frozen mountain

The Convention on Biological Diversity (CBD) that was adopted at Rio de Janeiro in 1992 calls for the conservation, sustainable and equitable use of biodiversity. However, the extinction of species and erosion of genes continue to occur at an alarming rate<sup>1</sup>. The modern techniques for germplasm storage especially based on cryopreservation are expensive and the permafrost storage is a preferred alternative. In Ladakh, the Defence Institute of High Altitude Research (DIHAR), a constituent laboratory of the Defence Research and Development Organisation, which has been mandated to carry out the sustainable agro-animal research in high altitude areas has created a 'permafrost-based germplasm storage facility' at 'Chang-La' situated at an altitude of 5360 m above mean sea level (amsl). This will serve as a safety net for current and future food security in an era of global warming and climate change. The Minister of State for Defence, M. M. Pallam Raju, inaugurated this facility on 25 September 2009. Apart from India, only Norway has the permafrost storage facility in the world.

The permafrost storage is a national facility which will keep germplasm at  $-4^{\circ}\text{C}$  to  $-20^{\circ}\text{C}$  temperature inside the structure with 10–20% moisture. The structure is designed on 'black box condition' storage mechanism, the storage boxes remain the property of the institu-

tion that submits to the germplasm bank and could be opened only with the depositor's permission, avoiding conflicts pertaining to intellectual property rights. There is a need to strengthen our infrastructure for the conservation, sustainable and equitable use of plant genetic resources<sup>2</sup>. This is why the preservation of at least a small seed sample of existing variability in long-term storage structures as in Chang-La assumes urgency.

The seed storage problems are more common in India, because a large part of the country has predominantly hot, humid, tropical and sub-tropical climate with great variation in temperatures, rainfall and relative humidity across the year. Hence for cost-effective conservation of important plant genetic resources for food and agriculture (PGRFA) as safety duplicates, it requires exploration and use of alternative methods of seed storage.

Fortunately, in Himalayan region there are various places with sub-zero temperatures and low relative humidity conditions. Capitalizing on these natural factors, DIHAR has selected Chang-La (75 km from Leh) for the creation of zero energy-based germplasm storage facility. The present structure at Chang-La is for the successful, cost-effective, safe and long-term conservation of valuable PGRFA in the form of safety duplicates. The other objectives with which the present facility is created include: (i) to

study the seed storage behaviour of a wide range of orthodox seed crops in terms of seed viability, genetic stability and health at definite intervals under the natural permafrost conditions vis-à-vis artificial low temperature conditions (long-term storage module in the gene bank), (ii) calculation of cost effectiveness of conservation of plant germplasm in high altitude areas vis-à-vis long-term storage module in the gene bank, and (iii) to use the natural permafrost conditions on continuous basis for conservation of a selected set of important plant germplasm. In conclusion, permafrost-based germplasm storage at Chang-La is an economically viable possibility that allows long-term preservation of valuable and endangered plant germplasm at the frozen mountain for current and future food security.

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