

IN VITRO PROPAGATION OF ECONOMICALLY IMPORTANT SOME INDIAN HIMALAYAN MEDICINAL PLANT SPECIES FOR CONSERVATION AND COMMERCIALIZATION

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Abstract: Medicinal and aromatic plants form an integral and essential part of the lives of hill communities, and the inhabitants depend on these plants for their use. These plants are well known source of active principles in Ayurvedic, Unani and other traditional systems of medicines. Being source of many high value drugs, and ever increasing global demand for the “naturals”, these species are being subjected to reckless, often illegal harvesting, well beyond their natural regeneration capacity. This has led to many species being listed in the Red Data Book or/in various threat categories of International Union for the Conservation of Nature and Natural Resources (IUCN). In order to face such challenges, biotechnological tools (in vitro propagation) can be used for rapid multiplication of elite clones to provide the much needed planting material for cultivation, and thus help in achieving the overall goal of conservation. The present paper deals in with the *in vitro* method being applied for some selected medicinal plants of Indian Himalayan Region (IHR).

Keywords: Conservation, Medicinal Plants, Propagation

REFERENCES

Abdi, G. and Khosh-Khui, M. (2007). Shoot regeneration via direct organogenesis from leaf segments of valerian (*Valeriana officinalis* L.). *International Journal of Agricultural Research* 2: 877–882.

Airi, S., Rawal, R.S., Udhar, U. and Purohit, A.N. (1997). Population studies on *Podophyllum hexandrum* Royle - a dwindling medicinal plant of the Himalaya. *Plant Genetic Resources Newsletter* 110: 29-34.

Anonymous (1988). The wealth of India. Dictionary of Indian raw material and industrial products. Raw materials, Vol. A. Publication and Information Directorate, CSIR New Delhi, India.

Anonymous (2003). Checklist of CITES species. UNEP World Conservation Monitoring Centre, Cambridge, pp 1-339.

Anonymous (2015). Annual Report 2014–15 Spices Board. Ministry of Commerce & Industry, Government of India, 137 p. <http://www.indian spices.com>.

Arumugam, N. and Bhojwani, S.S. (1990). Somatic embryogenesis in tissue cultures of *Podophyllum hexandrum* Royle. *Canadian Journal of Botany* 68: 487–491.

Bajaj, Y.P.S. (ed.) (1989). Biotechnology in agriculture and forestry: trees II, vol 5. Springer, Berlin, 622 p

Bhadula, S.K., Singh, A., Lata, H., Kuniyal, C.P. and Purohit, A.N. (1996). Genetic resource of *Podophyllum hexandrum* Royle, an endangered medicinal species from Garhwal Himalaya, India. *Plant Genetic Resources Newsletter* 106: 26-29.

Bhandari, P., Kumar, N., Singh, B., Gupta, A.P. and Kaul, V.K. (2009). Stability indicating LC-PDA method for determination of picosides in hepatoprotective Indian herbal preparations of *Picrorhiza kurrooa*. *Chromatographia* 69: 221-227.

Bisht, V.K., Negi, J.S., Bhandari, A.K. and Sundriyal, R.C. (2011). *Amomum subulatum* Roxb.: traditional, phytochemical and biological activities- An overview. *African Journal of Agricultural Research* 6: 5386–5390.

Bisht, V.K., Purohit, V., Negi, J.S. and Bhandari, A.K. (2010). Introduction and advancement in cultivation of large cardamom (*Amomum subulatum* Roxb.) in Uttarakhand, India. *Research Journal of Agricultural Sciences* 1: 205-208.

Chaudhary, L.B. and Rao, R.R. (1998). Notes on the genus *Aconitum* L. (Ranunculaceae) in north west Himalaya (India). *Feddes Repertorium*, 109: 527-537.

CAMP (2003). Conservation assessment and management prioritization for the medicinal plants of Himachal Pradesh, Jammu & Kashmir and Uttarakhand. In: Proceedings of the workshop held at Shimla, Hosted by Foundation for Revitalisation of local Health Traditions (FRLHT), Bangalore, India

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- Canel, C., Moraes, R.M., Dyan, F.E. and Ferreira, D.** (2000). Molecules of interest: Podophyllotoxin. *Phytochemistry* 54: 115-120.
- Chandra, B., Palni, L.M.S. and Nandi, S.K.** (2006). Propagation and conservation of *Picrorhiza kurrooa* Royle ex. Benth: an endangered Himalayan medicinal herb of commercial value. *Biodiversity and Conservation* 15: 2325-2338.
- Chopra, R. N., Badhwar, R. L. and Ghosh, S.** (1984). Poisonous plants of India, Vol. I, Academic Publishers, Jaipur, India.
- Constabel, F.** (1990). Medicinal plant biotechnology. *Planta Medica* 56: 421-426.
- De Carvalho, C.M.B., Maurmann, N., Luz, D.I., Fett-Neto, A.G. and Rech, S.B.** (2004). Control of development and velpotriate production by auxins in micro propagated *Valeriana glechomifolia*. *Plant Cell Reports* 23: 251-255.
- Enciso-Rodriguez, R.** (1997). Micropropagation of *Valeria naedulis* spp. procera. *Planta Medica* 63: 274-275.
- Farnsworth, N.R. and Soejarto, D.D.** (1991). Global importance of medicinal plants. In: Akerele O., Heywood V. and Synge H. (eds.). *The Conservation of Medicinal Plants*. Cambridge University Press, Cambridge, UK, pp. 25-51.
- Frances, A.** (2004). Seed storage characteristics and germination of south florida native plant seeds. Fairchild tropical botanic garden. <http://www.ftg.org/PDF20Files/SeedStorageBehavior>
- Jia, Q., Hong, M.F. and Minter, D.** (1999). Pikuroside: a novel iridoid from *Picrorhiza kurrooa*. *Journal of Natural Products* 62: 901-903.
- Kala, C.P.** (2010). Assessment of availability and patterns in collection of Timroo (*Zanthoxylum armatum* DC.): a case study of Uttarakhand Himalaya. *Medicinal Plants* 2: 91-96.
- Kitagawa, I., Hino, K., Nishimura T., Mukai, E., Yosioak I., Inouye H. and Yoshida T.** (1969). Picroside I: a bitter principle of *Picrorhiza kurrooa*. *Tetrahedron Letters* 43: 3837-3840.
- Kadota, Y.** (1987). A Revision of *Aconitum* Subgenus *Aconitum* (Ranunculaceae) of East Asia. Sanwa Shoyaku Co. Ltd., Utsunomiya, pp. 1-65
- Kumar, A., and Mishra R.N.** (2011). Computer based taxonomy in the identification of ethnomedicinal plants of Shakumbhari Devi of Shiwalik hills. *The Journal of Indian Botanical Society*, 90(3&4) 244-250.
- Kumar, A. and Sharma, A.** (2011). Status and conservation of some commercially exploited medicinal and aromatic plants of shakumbharidevi region of shiwalik hill. *J. of Env. Bio-Sci.* 25 (2):269-272.
- Lee, K.H. and Xiao, Z.** (2005). Podophyllotoxin and analogs. In: Cragg, G.M., Kingston, D.G.I., Newman, D.J. (eds) *Anticancer agents from natural products*. Brunner-Routledge Psychology Press, Taylor & Francis Group, Boca Raton, pp 71-88.
- Mishra, L.C.** (2004). *Scientific Basis for Ayurvedic Therapies*. CRC Press, New York, USA.
- Mukhopadhyay, M., Bantawa, P., Mondal, T.K. and Nandi, S.K.** (2016). Biological and phylogenetic advancements of *Gaultheria fragrantissima*: Economically important oil bearing medicinal plant. *Industrial Crops and Products* 81:91-99.
- Murashige, T. and Skoog, F.** (1962). A revised medium for rapid growth and bioassay with tobacco tissue culture. *Physiologia Plantarum* 15:473-497.
- Nadeem, M., Palni, L.M.S., Purohit, A.N., Pandey, H. and Nandi, S.K.** (2000). Propagation and conservation of *Podophyllum hexandrum* Royle: an important medicinal herb. *Biological Conservation* 92: 121-129.
- Nandi, S.K., Palni, L.M.S. and Kumar, A. (Eds.).** (2002). *Role of Plant Tissue Culture in Biodiversity Conservation and Economic Development*. Himvikas Occasional Publication No. 15. GyanodayaPrakashan, Nainital, p. 646, ISBN: 81-85097-55-0.
- Nandi, S.K., Palni, L.M.S., Pandey, H., Chandra, B. and Nadeem, M.** (2016). Selection of Elites and *in vitro* propagation of selected high-value Himalayan medicinal herbs for sustainable utilization and conservation. In *Plant Tissue Culture: Propagation, Conservation and Crop Improvement*, pp. 15-44; Springer Singapore. (DOI 10.1007/978-981-10-1917-3_2).
- Pandey, H., Nandi, S.K., Kumar, A., Palni, U.T., Chandra, B. and Palni, L.M.S.** (2004). *In vitro* propagation of *Aconitum balfourii* Stapf.: an important aconite of the Himalayan alpine. *Journal of Horticultural Science and Biotechnology* 79: 34-41.
- Pandey, H., Nandi, S.K., Nadeem, M. and Palni, L.M.S.** (2000). Chemical stimulation of seed germination in *Aconitum heterophyllum* Wall. and *A. balfourii* Stapf.: important Himalayan species of medicinal value. *Seed Science and Technology* 28: 39-48.
- Patel, P.K., Kumar, A., Sharma, A. and Dhiman, M.** (2011a). Ethnomedicinal survey of the Rishikesh and neighbouring area. *J. Env. Bio-Sci.*, 25 (2):241-246
- Patel, P.K., Kumar, A., Sharma, A. and Dhiman, M.** (2011b). Traditional knowledge on medicinal plants used by van gujjar of shakumbharidevi of shiwalik hills. *Plant Archives* 11 (2): 587-592.
- Pei, S.** (2001). Ethnobotanical approaches of traditional medicine studies: some experiences from Asia. *Pharmaceutical Biology* 39: 74-79.
- Prakash, V.** (1999). *Indian Valerianaceae: A Monograph on Medicinally Important Family*. Scientific Publishers, Jodhpur, India, 70 p.
- Purohit, S., Nandi, S.K., Paul, S., Tariq, M. and Palni, L.M.S.** (2016). Micropropagation and genetic fidelity analysis in *Amomum subulatum* Roxb. *Journal of Applied Research on Medicinal and Aromatic Plants* DOI:10.1016/j.jarmap.2016.07.003

- Purohit, S., Rawat, V., Jugran, A.K., Singh, R.V., Bhatt, I.D. and Nandi, S.K.** (2015). Micro propagation and genetic fidelity analysis in *Valeriana jatamansi* Jones. *Journal of Applied Research on Medicinal and Aromatic Plants* 2: 15-20.
- Rastogi, R.P., Sharma, V.N. and Siddiqui, S.** (1949). Chemical examination of *Picrorhiza kurrooa* Benth. *Indian J.Sci. Ind. Res* 8B: 172.
- Reza, A.G., Morteza, K.K. and Akhtar, S.** (2009). Rapid micro propagation through shoot regeneration of *Valeriana officinalis* L. *Horticulture Environment and Biotechnology* 5 0: 467-471.
- Rikhari, H. C., Palni, L. M. S., Sharma, S. and Nandi, S. K.** (1998). Himalayan yew: Stand structure, canopy damage, regeneration and conservation strategy. *Environmental Conservation* 25: 334-341.
- Salles, L.A., Silva, A.L., Fett-Neto, A.G., Von Poser, G.L. and Rech, S.B.** (2002). *Valeriana glechomifolia*: in vitro propagation and production of valepotriates. *Plant Science* 1 63:165-168.
- Samant, S. S., Dhar, U. and Palni, L. M. S.** (1998). Medicinal plants of Indian Himalaya: Diversity, distribution and potential values. Himavikas Publication, GyanodayaPrakashan, Nainital, India.
- Schacter, L.** (1996). Etoposide phosphate: what, why, where and how? *Seminars in Oncology* 23:1-7.
- Shah, N.C.** (2005). Conservation aspect of Aconitum species in the Himalayas with special reference to Uttarakhand India. *Med. Plant Conserv.*, 11: 9-15. <http://cmsdata.iucn.org/downloads/mpc11.pdf>
- Sharma, E., Sharma, R. and Singh, K.K.** (2000). A boon for mountain populations: large cardamom farming in the Sikkim Himalaya. *Mountain Research and Development* 20:108-111.
- Singh, N., Gupta, A.P., Singh, B. and Kaul, V.K.** (2006). Quantification of valeric acid in *Valeriana jatamansi* and *Valeriana officinalis* by HPTLC. *Chromatographia* 63:209-213.
- Smit, H.F., Berg, A.J.J., van den Kroes, B.H., Beukelman, C.J., Ufford, H.C., Quarles, V., Dijk, H.V. and Labadie, R.P.** (2000). Inhibition of T-lymphocyte proliferation by cucurbitacins from *P. scrophula riiflora*. *Journal of Natural Products* 63: 1300-1302.
- Sturm, S. and Stuppner, H.** (2000). Analysis of cucurbitacins in medicinal plants by high pressure liquid chromatography-mass spectrometry. *Phytochemical Analysis* 11: 121-127.
- Thakur, R. S., Puri, H.S. and Hussain A.** (1989). Major Medicinal Plants of India. CIMAP, Lucknow, pp.404-407
- Van Uden, W., Pras, N., Visser, J.F. and Malingre, T.M.** (1989). Detection and identification of podophyllotoxin produced by cell cultures derived from *Podophyllum hexandrum* Royle. *Plant Cell Reports* 8: 165-168.
- Ved, D.K., Kinhal, G.A., Ravikumar, K., Prabhakaran, V., Ghate, U., Vijaya, S.R. and Indresha, J.H.** (2003). Conservation assessment and management prioritization for the medicinal plants of Himachal Pradesh, Jammu & Kashmir and Uttarakhand. Foundation of Revitalization of Local Health Traditions (FRLHT), Bangalore, pp 1-24
- Verma, S.K., Rajeevan, V., Bordia, A. and Jain, V.** (2010). Greater cardamom (*Amomum subulatum* Roxb.), a cardio-adaptogen against physical stress. *Journal of Herbal Medicine and Toxicology* 4: 55-58.
- Violon, C, Van, C.N. and Vercruyse, A.** (1983). Valepotriate content in different in vitro cultures of Valerianaceae. *PharmaceutischWeekblad* 5: 205-209.
- Winges, K., Kloss, P. and Henkels, W.D.** (1972). Natural products from medicinal plants. XVII, picroside II, a new 6-vanilloyl catapol from *Picrorhiza kurrooa*. *LeibigsAnnalenChem* 759: 173-182.
- Wochock, Z.S.** (1981). The role of tissue culture in preserving threatened and endangered plant species. *Biological Conservation* 20: 83-89.