Training schools

In an interesting historical account, Dasannacharya[1] has highlighted 50 years of DAE training school, he has referred to 'Homi Bhabha National Institute' (HBNI), which can award postgraduate degrees. The justification given by the author for having a new institute is to develop new facilities, which does not necessarily appear to be correct. No one is preventing an R&D organization, whether BARC, CSIR, IIT or even a university to build new facilities. Many Advanced Centres created in universities by the UGC, as well as in IISc and in IITs, are doing commendable work. A horizontal interaction of BARC with universities and IITs would have served even better cross-fertilization. Any young scientist/engineer from the DAE can register externally for higher degrees in an university or IIT. In doing so periodical visits from both sides are necessary and should be encouraged. If one is not amenable to do so, then the desirability of better interaction with academia appears a mere lip-service. If I am not wrong, many scientists from BARC, in the past, have successfully received their Ph D degrees from Bombay University or IIT Mumbai under the external registration mode. In case of some academic impediment, the answer lies in mitigating that aspect in a thoughtful and nonpartisan manner.

The other point that I would like to raise is the quality of scientific manpower available currently for the Training School. Dasannacharya has not made any comparative study on the calibre of earlier batches with the recent ones. I think this aspect needs to be tackled more objectively.

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Response:

In my account of HBNI, I have not given any justification for starting the Institute. I have only expressed a hope that the emphasis in HBNI could be different compared to that in existing universities in relation to undertaking large projects. Universities manage major laboratories in USA and such laboratories are embedded in French universities.

The issue is not of someone preventing anyone from building new facilities; the crux of the problem lies in creating an atmosphere in which such efforts are given due importance by the funding agencies as well as the academic community.

I am myself a Ph D of Bombay University from BARC, and am aware of some good efforts towards cross-fertilization, having taken part in some of it myself. They are commendable and, as far as I am aware, encouraged by all the concerned parties.

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Seabuckthorn: An emerging storehouse for researchers in India

Seabuckthorn (*Hippophae rhamnoides* L.), a deciduous thorny shrub with silvery leaves and red, orange or yellow berries (Figure 1), is widely distributed in the cold desert of Ladakh region, covering an area of 11,500 ha in Leh District[1]. The shrub has unique characteristics that can be explored for biotechnological, neutraceutical, pharmaceutical and environmental usage. The plant can withstand extreme temperatures from –43°C to +40°C, and is drought-tolerant. Seabuckthorn has been found growing well in sandy, rocky, saline and ravine soils. These characteristics can be explored as a source of important genes for developing abiotic stress-tolerant plants. Biotechnological potential of seabuckthorn has been recognized by the Department of Biotechnology, Government of India, which has recently called for project proposals exclusively on seabuckthorn (www.dbtindia.nic.in).

Seabuckthorn berries are among the most nutritious of all fruits. Vitamin C represents a nutrient of major importance because of its presence in large quantities ranging from 200 to 2500 mg/100 g berries[2]. Considering that fresh orange juice and aonla contain 35–56 mg and 478.5 mg/100 ml juice, the value of seabuckthorn as a source of vitamin C is apparent. Similarly, concentration of the antioxidants vitamins A and B2 is higher than in other fruits and vegetables, such as carrot, tomato and orange. Seabuckthorn fruit is also exceptionally rich in tocopherols and tocotrienols. Total content of tocotrienols varies from 1.5 to 8.1 mg/kg in berries and from 43 to 188 mg/kg in berry oil[3]. The contents of these bioactive compounds are among the crucial criteria defining the quality of seabuckthorn.

Seabuckthorn contains 1.5–3.5% oil in pulp and 9.9–19.5% in seeds. The oil absorbs ultraviolet light and promotes healthy skin. This unique property is being

Figure 1. Nutrient-rich seabuckthorn berries.

recognized and sought after by the cosmetic industry. The oil from seed and juice also contains vitamin E and carotene. Oil derived from juice contains more vitamin E (216 mg/100 g fruit) than seed (64.4–92.7 mg/100 g seed). Presence of high tocopherol content has significant health effects, acting as a natural antioxidant in the human body. Phytosterol is also a constituent of seabuckthorn oil, which is capable of lowering plasma cholesterol on consumption by humans. Total quantity of phytosterol in whole seabuckthorn berries ranges from 350 to 520 mg/kg and thus exceeds that in soybean oil by 4–20 times[4].

In Ladakh, preparations from seabuckthorn are used by the Amchies (local traditional doctors) for treatment of common ailments. Modern scientific research has shown that the shrub has potential application for treatment of sluggish digestion, stomach malfunctioning, neoplasia, thrombosis, hepatic injury, tendon and ligament injuries. Seabuckthorn is traditionally used in the treatment of gastric ulcer and laboratory studies confirm the efficacy of the seed oil for this application. Clinical trials on patients with ischaemic heart disease have shown that total flavonoids of seabuckthorn reduce cholesterol level and improve cardiac function[5]. Laboratory studies have also demonstrated that seabuckthorn oil is effective in cancer therapy[6]. Similarly, seabuckthorn leaves have been known to have significant antioxidant, immunomodulatory and anti-inflammatory activities[7]. Thus the plant is a storehouse of bioactive compounds with a variety of medicinal properties. Preliminary studies have thus opened a door to investigate the shrub for novel compounds for treatment of a wide range of diseases.

Seabuckthorn brings many environmental benefits, including soil and water conservation, desertification control and land reclamation in fragile cold desert ecosystem. The shrub develops an extensive root system having symbiotic association with microorganism belonging to the genus *Frankia*. The symbiotic association has the ability to fix 180 kg of nitrogen/ha/yr, which generally improves soil fertility[8]. Seabuckthorn plantations can serve as windbreaks to prevent wind erosion in open areas. Plants that serve as windbreaks must be resistant to the drying effects and physical injuries caused by the wind, and seabuckthorn is well suited for this. The thorny shrub has proven to be beneficial in acting as a barrier to pedestrian traffic, preventing sensitive vegetation from being trampled. Traditionally the shrub is planted around agricultural fields and plantation sites to protect against stray animals. Seabuckthorn is a potential green energy plant because of its quality biomass. The calorific value of dry seabuckthorn is 4785.5 calories/kg. In a six-year-old seabuckthorn forest, each hectare can produce 18 tonnes of firewood, equal to nearly 12.6 tonnes of standard coal. The shrub grows fast and can be stumped every 3–5 years, thereby reducing the harvesting pressure on other native woody plants. A number of wildlife species depend on seabuckthorn for food. Thorny and bushy growth of seabuckthorn provides a protective shelter for flora and fauna, thereby maintaining the fragile ecosystem of the cold deserts. Seabuckthorn has immense potential to change the livelihood of the rural populace. From Leh District, Ladakh region, seabuckthorn pulp worth Rs 1.4 crore has been sold in 2007. This accounts for less than 5% of the potential of the region and, if fully utilized, the shrub can change the entire economy of the region. Popularity of seabuckthorn berries from Ladakh can be judged from the fact that the price of the berries has jumped from Rs 8/kg in 2001 to Rs 22/kg in 2007. The unique characteristics of seabuckthorn in improving the fragile ecosystem and socio-economic upliftment of the rural cold desert region are receiving attention from environmentalists and the Government. The Indian Council of Agricultural Research has recommended a concept note on seabuckthorn under the National Agricultural Innovation Project scheme (www.naip.icar.org.in).

In view of the unique and valuable characteristics of seabuckthorn, the shrub serves as a storehouse for researchers in the field of biotechnology, neutraceutical, pharmaceutical, cosmetic and environmental sciences. It may serve as an example of how a lesser known shrub that grows in the tribal areas of the Himalayas can benefit the modern society through scientific research.

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