(HME), affecting the liver, skeletal and heart muscles and the brain, indicated by very high levels of liver and muscle enzymes in the blood, and caused by children eating the raw unripe beans of an annual weed plant, *Cassia occidentalis*[3–5]. The toxin was identified and characterized as anthraquinones, which could be detected in urine samples of sick children[6].

In Bihar, the disease was acute hypoglycaemic encephalopathy triggered in malnourished children who missed their evening meals, by an inhibitor of mitochondrial fatty acid oxidation cycle of neoglucogenesis. The inhibitor was found to be methylene cyclopropyl glycine, present in the edible portion of litchi fruits[7–10]. Cases occurred only during litchi harvesting season[7,8].

Malkangiri district has no litchi cultivation and so litchi-associated hypoglycaemic encephalopathy was ruled out. On the other hand, *Cassia occidentalis* grows luxuriantly, and we found that children have easy access to the plants and the pods with beans (Figure 1). Suspecting hepatomyoencephalopathy as the non-JE disease, we investigated blood sera of 15 children; all showed markedly elevated levels of liver and muscle enzymes (Table 1). In 8 of the 15 cases, blood sugar was tested and the results showed hypoglycaemia, ranging from 11 to 61 mg/dl. Hypoglycaemia was a feature in hepatomyoencephalopathy cases in western UP[3–5].

Since history of children eating the fresh raw beans prior to illness could not be ascertained with certainty, we resorted to testing urine samples of four children with hepatomyoencephalopathy for the presence of anthraquinone derivative(s), and all samples gave positive results. Figure 2 displays the liquid chromatography–mass spectra (LC–MS) of representative sample of urine showing the presence emodin, an anthraquinone. Detailed analysis of anthraquinone derivatives in blood sera and urine samples of additional children with hepatomyoencephalopathy is under progress.

In summary, we report the occurrence of hepatomyoencephalopathy in Malkangiri district, a second geographic location other than western UP. Prevention is fairly easy, by way of public education to stop children form eating fresh raw beans of the plant. In western UP the disease has virtually disappeared as a result of proper health education[11]. We hope similar efforts are undertaken in Malkangiri district for eradication of the disease.

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ACKNOWLEDGEMENTS. We thank Ms Arti Ahuja (Principal Secretary, Department of Health, Government of Odisha) for authorizing us to conduct the investigation. Thanks are due to Dr S. P. Singh for LC–MS analysis.

Received 2 December 2016; accepted 1 December 2017

T. JACOB JOHN[1]
G. ARUNKUMAR[2]
MADAN M. PRADHAN[3]
MUKUL DAS[4,*]

[1]*No. 439, Civil Supplies Godown Lane, Kamalakshipuram, Vellore 632 002, India*
[2]*Manipal Centre for Virus Research, Manipal University, Manipal 576 104, India*
[3]*National Vector Borne Disease Control Programme, Odisha, Behind Capital Hospital, Unit VI, Bhubaneswar 751 001, India*
[4]*CSIR-Indian Institute of Toxicology Research, 31 Vish Vigyan Bhawan, M. G. Marg, Lucknow 226 001, India*
**For correspondence.*
e-mail: mditrc@rediffmail.com

Solar-powered on-farm storage structure for fruits and vegetables

Preserving fruits and vegetables in cold storage has been a critical area of concern because at low temperature, these perishable commodities can be preserved in their wholesome state for longer periods. However, the absence of cold storage facilities to accommodate the ever-increasing supply of fruits and vegetables has compelled the producers to adopt alternative storage practices; practices that in effect would preferably be economical than renting space in cold store and more efficient than rustic storage producers[1].

Fruits and vegetables are highly perishable, and if not properly handled at their optimum condition after harvesting or during packaging or transportation; they easily deteriorate and become unsuitable for consumption[2]. The world over postharvest losses are estimated at an average of 30–40% in fruits and vegetables before they reach the final consumer[3]. The postharvest losses of fruits and vegetables in India are about 30–35% (ref. 4).

Temperature and relative humidity are the two most important environmental factors influencing the quality and storage life of fresh produce[5,6]. If the surrounding air temperature is decreased to create storage at optimum levels within 4 h, the following are achieved: decrease in produce respiration rate; reduction of water loss from produce; concealment of ethylene production and significant reduction in microbial activity[4]. In India, hot and dry weather prevails for a noteworthy part of the year. Surrounding hot and dry weather is suitable for efficient working of the evaporatively cooled storage structure (ECSS)[7,8]. Evaporative cooling is the simplest and most-economical method for extending the shelf life of fruits and vegetables, and can also be used as ripening chamber for banana[9,10].

In India, considerable fraction of rural population does not enjoy the grid electricity; there are about 94,000 villages without electricity in the country. Of these, 25,000 villages are located in such remote areas that extension of existing electricity grid is not economically viable. Thus, for installation of evaporative cooled structures in rural areas, the requirement of electricity on a continuous basis imposes a significant restriction, leading to increased cost and reduced operational reliability.

For regions where solar radiation is available in abundance, as in the plains of the Indian subcontinent, use of solar energy to power a system is a viable option. The solar energy in DC mode is used for various applications. However, the cost of DC appliances is more compared to the existing AC appliances. The solar power generated is of DC type, which is used directly to run the DC appliances. However, if DC is converted into AC with the help of an inverter, the AC power can be conveniently used to operate the available conventional AC appliances without investing extra cost[11].

In view of the above, a solar-powered on-farm storage structure (SPOSS) for fruits and vegetables was developed for preserving fresh fruits and vegetables to extend their shelf life and to reduce the postharvest losses. It would be of immense value to the farmers to increase their income by way of preserving the fresh produce with retention of quality.

The SPOSS (Figure 1) was designed, fabricated and tested in the Division of Agricultural Engineering, Indian Agricultural Research Institute, New Delhi. A 4 m^3 storage capacity structure (1.8 m length × 1.5 m width × 1.6 m height) with 30 cm high trapezium roof was fabricated. For insulating the structure from the top, it was covered with corrugated asbestos sheet. It was also provided with an exhaust fan at the top to control the relative humidity and reduce CO_2 concentration released by the stored fruits and vegetables inside the chambers. It also circulates the air and helps maintain temperature and relative humidity inside the SPOSS. The structure has a four-way entrance and one-way air exit from the top. Four sets of cooling pads (CELdek pads, wood wool pads and khas pads) are installed at each entrance.

Figure 1. Solar-powered on-farm storage structure.

Figure 2. Solar photovoltaic panel for operating the cooling system of SPOSS.

Figure 3. Solar inverter and battery backup of the SPV system.

The solar photovoltaic (SPV) system consists of four photovoltaic solar panels (60 Wp each), one solar inverter (1400 VA) and a battery bank (12V/75 Ah, 2 nos) (Figures 2 and 3). With the help of the solar inverter, DC electricity from the solar panels was converted into AC electricity to operate a fan (48 W) and a water pump (40 W). The storage cabin has storage volume of 4 m^3 or 500 kg of fresh fruits and vegetables.

The water distribution network consists of a pipe network, a distribution and collection tank, and a bottom channel to take excess water to the tank. The water distribution system is fitted on the top of this frame and water is distributed over the upper face of the evaporative pad using a tube with several holes, so that the water drips evenly onto the pad face. A 40 l/min underwater cooler pump is used for recirculation of water through the pad. The water collected by the bottom gutter is returned to a sump of 500 l, from which it is pumped to the upper distribution pipe or gutter.

A negative pressure is needed to be created inside the structure which is a function of the pad and the fan. When this happens, air at a positive pressure rushes into the system through the pad. For proper air circulation, the fan is located at the central position at the top to allow air to be drawn from the wet pads, which in turn draws the cool air and expels the humidified air.

The axial-flow three-blade exhaust fan with sweep diameter 225 mm, power rating 48 W and 1300 rpm is fixed at the top of the SPOSS to control the relative humidity and reduce the concentration of carbon dioxide released by the stored produce inside the structure.

There was significant difference in cooling efficiency between the three types of cooling pad materials. The commercial cellulose pads (CELdek) when used an four sides showed the highest air-cooling efficiency (approximately 80%) for 50 mm pad thickness compared to the other two local alternative pad materials (khas and wood wool pads).

The ambient air dry bulb temperature (DBT) was 33–41°C with the average being 35.6°C and the ambient relative humidity was 19–40% with the average being 32% during the 12 days of experiment. The average temperature and relative humidity inside the SPOSS were 28–30°C and 25–60% respectively. The temperature inside the SPOSS decreased, while there was an increase in the relative humidity. The maximum difference in relative humidity and dry bulb temperature between ambient and inside the storage structure was 59% and 14.6°C respectively (Figure 4), when CELdek pad was used on four sides in the SPOSS. The inside temperature was near the wet bulb temperature (WBT) and there was further scope to reduce the inside temperature (DBT).

For testing the SPOSS, low shelf life vegetables such as spinach, green beans, pointed gourd, cucumber, bottle gourd, capsicum, tomato and papaya were used.

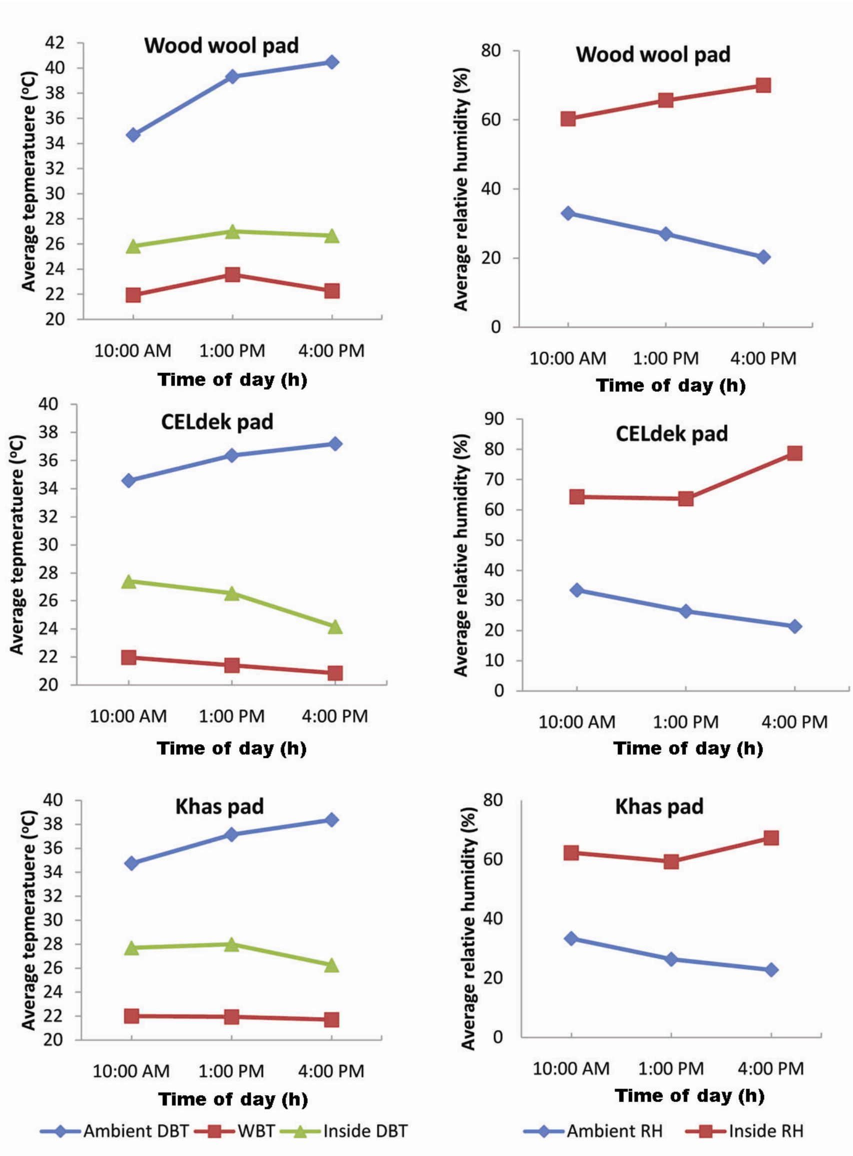

Figure 4. Hourly variation of temperature and relative humidity for ambient and inside the SPOSS.

Table 1. Change in shelf life of fruits and vegetables when stored in evaporatively cooled storage structure and in room conditions

Produce	Shelf life (days) In SPOSS	Shelf life (days) In room conditions
Spinach	3	2
Green beans	3	2
Pointed gourd	3	2
Cucumber	5	3
Capsicum	>7	4
Bottle gourd	>8	4
Tomato	>12	7
Papaya	>8	4

There was significant difference in physiological loss in weight (%) and firmness values of fruits and vegetables stored in the SPOSS than those stored in room (ambient) conditions. The shelf life for different fruits and vegetables when stored in the SPOSS increased by around 1–5 days compared to room storage (Table 1). This might be due to the fact that fruits and vegetables require low temperature and high humidity to help increase their shelf life.

The difference in initial and final firmness of produce was found to be highest in case of room storage in each of the fruits and vegetables, while the low difference was found in the SPOSS.

The SPOSS could be more efficient for the storage of fruits and vegetables where the climate is mainly hot and dry. It has advantages like low cost of manufacturing, negligible operational cost and is better than the mechanical refrigeration. It can be used in a place where cold storage facility is not available due to unavailability/erratic supply of electricity. With the help of storage of fruits and vegetables in SPOSS, the shelf life of these products is increased substantially enabling them to remain fresh and to reduce the losses. It would be of immense value to the farmers to increase their income by way of preserving the fresh produce with retention of quality.

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Received 7 June 2016; revised accepted 7 November 2017

P. K. Sharma[1,*]
S. M. Mansuri[2]
D. V. K. Samuel[1]

[1]*Division of Agricultural Engineering, Indian Agricultural Research Institute, New Delhi 110 012, India*
[2]*Central Institute of Agricultural Engineering, Bhopal 462 038, India*
**For correspondence.*
e-mail: pks_ageg@iari.res.in

Polygonum polystachyum: peril to biodiversity of the alpine ecosystem, Western Himalaya, India

The serious problem facing the managers of protected areas and conservationists is how to maintain biodiversity in the face of natural and anthropogenic perturbations. Biological invasion as an anthropogenic ecological perturbation is threatening endemic biodiversity, preventing natural ecological succession and changing the community structure and composition, besides impacting the ecosystem services[1]. *Polygonum polystachium* Wall. ex Meisn., is an herbaceous native species to Himalayan Region that belongs to family Polygonaceae. It reproduces vegetatively from rhizomes as well as from seeds. It is considered one of the native aggressive colonizing species or local invader in Western Himalaya, and a noxious invasive species in other countries. This species has been colonizing and disrupting plant diversity of the world heritage site, Nanda Devi Biosphere Reserve (NDBR), Uttarakhand, India. The reserve has two core zones, i.e. Valley of Flowers National Park (VoFNP) and Nanda Devi National Park (NDNP) and both the National Parks (NPs; core area) have been inscribed on the World Heritage list by UNESCO. The reserve is characterized by richness, nativity and endemism of high-value medicinal plants (*Aconitum heterophyllum*, *Ephedra intermedia, Aconitum balfourii*, *Angelica glauca*, *Saussurea obvallata*, *Fritillaria roylei*, *Podophyllum hexandrum*, *Nardostachys grandiflora*, *Polygonatum cirrhifolium*, *Dactylorhiza hatagirea*, etc.), and wild edibles (*Rhododendron arboreum*, *Diplazium esculentum*, *Hippophae salicifolia*, *Morchella esculenta*, *Allium* spp., etc.). However, in recent decades, *P. polystachyum* has become a massive threat to plant diversity of the NPs particularly VoFNP and other alpine areas of the Reserve, as it grows vigorously and creates dense colonies by excluding other species (Figure 1). Initially, *P. polystachyum* was confined to the disturbed habitat types such as eroded slopes, bouldery area and avalanche-prone areas[2]. Presently, it is seen proliferating in large areas of VoFNP, many areas of NDNP and other alpine areas of the reserve. Therefore, the objective of the present study was to assess the status of *P. polystachyum* proliferation and its major impact on the plant diversity of NDBR.

P. polystachyum-dominated stands were taken as invaded sites and natural area as uninvaded sites for the present study. Quadrat method was used to study the plant species diversity and density in different habitat types. For sampling of herbaceous vegetation, 50 × 50 m plots were marked in each altitudinal belt and 25 quadrats (1 × 1 m) in each plot were laid randomly. The vegetation was analysed for various ecological parameters following Misra[3], Mueller-Dombois and