India-based Neutrino Observatory

We have noted with concern the Opinion piece which appeared in *Current Science*[1]. As members of the INO collaboration we are deeply disturbed by the publication of this tirade masquerading as 'scientific opinion'. We are also surprised that the editors of *Current Science* deemed it fit to be published without giving an opportunity to the proponents of the project to simultaneously counter the misinformation, factual errors and sweeping generalizations contained in the note. The editors could have at least checked with some expert engineers and/or geologists to verify the statements made in the note.

Without going into details, we would like to bring the following obvious facts to the attention of readers.

1. Tunnelling is a routine activity in mountains (even in the Himalayas which is the most seismically active region in India or anywhere in the world), under the rivers and seas, and even under mega cities for metro rail transportation. The technology has improved tremendously in the last few decades. It is hard to believe that such an activity can cause major or even minor earthquakes.

2. The authors claim that no geotechnical study has been carried out. This again is incorrect. It was on the advice of geologists of GSI that the site was chosen and the rock characterization using bore hole data, surface characteristics and other available observations has been done. Such measures are important not only for the safety of the environment around, but also for the safety of scientists working in the underground laboratory.

3. The Opinion[1] is only one of many articles against the project that one of the authors (V.T.P.) has been writing, but what makes this more serious from our point of view is that it is published in a leading journal like *Current Science* and not in any newspaper or blog, where there is no peer review, as was the case earlier. We have responded to the earlier articles giving as much information and clarifications as we could. One main criticism of V.T.P. that INO is not transparent, has no basis at all. We have been putting out the details pertaining to the project on our website for more than a decade.

We are definitely open to criticism and welcome scientists and others to critically assess and even provide necessary assistance to improve and execute the project. Indeed a journal like *Current Science* published in collaboration with a leading science academy of the country has an important role, and even an obligation, in promoting science in the country by providing a platform for informed discussion and to develop a vision. Sadly, in this instance *Current Science* is being used as a vehicle to promote misinformation.

1. Padmanabhan, V. T. and Makkolil, J., *Curr. Sci.*, 2013, **104**, 414–416.

B. S. ACHARYA, TIFR, Mumbai
SANJIB KUMAR AGARWALLA, Institute of Physics, Bhubaneswar
PRAFULLA KUMAR BEHERA, IIT Madras, Chennai
ANJU BHASIN, University of Jammu, Jammu
SUBHASISH CHATTOPADHYAY, VECC, Kolkata
SANDHYA CHOUBEY, Harish Chandra Research Institute, Allahabad
VIVEK DATAR, BARC, Mumbai
RAJ GANDHI, Harish Chandra Research Institute, Allahabad
GAUTAM GANGOPADHYAY, University of Calcutta, Kolkata
SRUBABATI GOSWAMI, PRL, Ahmedabad
RASHID HASAN, Aligarh Muslim University, Aligarh
D. INDUMATHI, IMSc, Chennai
NABA K. MONDAL*, TIFR, Mumbai
M. V. N. MURTHY, IMSc, Chennai
MD NAIMUDDIN, University of Delhi, Delhi
G. RAJASEKARAN, IMSc/CMI, Chennai
C. RANGANATHAIAH, University of Mysore, Mysore
AMITAVA RAYCHAUDHURI, University of Calcutta, Kolkata
VENKTESH SINGH, BHU, Varanasi
NITA SINHA, IMSc, Chennai
A. M. VINODKUMAR, University of Calicut, Calicut
Y. P. VIYOGI, VECC, Kolkata
**e-mail: nkm@tifr.res.in*

The earliest findings on the role of smoke as a germination cue were reported by P. Parija and co-workers from India

In a recent review, Nelson *et al.*[1] have summarized earlier work related to the role of smoke from burning vegetation as a germination cue. They have stated that first evidences for the role of fire-generated chemical stimulants in increasing the seed germination of dormant seeds of post-fire annuals from California Chaparral were reported in 1977 (ref. 2) and 1985 (ref. 3). More detailed studies showed the presence of one or more water-soluble germination stimulants in the burnt or charred woody material[4]. Finally, in 1990, De Lange and Boucher[5] reported the key discovery that smoke from burning plant material stimulated germination of the South African species *Audouinia capitata* (Bruniaceae).

On tracing the earlier work done on the promotion of germination of dormant seeds in India, a study by Parija *et al.*[6] reported in 1940 came to light. They had reported the application of smoke in breaking dormancy of rice seeds. In their abstract entitled 'Breaking of dormancy in winter paddy', published in the Proceedings of the 27th Indian Science Congress held at Madras in 1940, they have stated that 'Winter paddies do not germinate immediately after harvest. They require certain period of after-maturity before they germinate. Preliminary experiments conducted with winter paddies showed that the mid and late Aman varieties gave 50% germination 30 days after the harvest, which gradually rose to 75% in 45 days.' They further state that 'Three methods were employed for breaking dormancy, viz. subjecting

the seeds to smoking on two or three days for 2 to 3 hours daily according to the class of paddy, early medium or late.' They reported that this treatment was effective in breaking the dormancy of rice seeds after a minimum resting period of 15 days. Whereas normally a period of 30 days after harvest was required for achieving 50% germination, which gradually rose to 75% in 45 days. They concluded that by breaking the dormancy of rice seeds (by smoke, reducing moisture and removal of husk), the winter rice varieties can be sown after a short period of 15 days or immediately after their harvest. Subsequently, this work[6] was also cited in relation to the role of flowering glumes of rice seeds for imparting dormancy[7] and later in the context of dormancy breaking effect of smoking the seeds[8]. But its citation in the later publications could not be done and therefore it may have remained obscure to researchers of the present time, e.g. the work of Parija *et al.*[6] is not mentioned in the historical background given in the recent review[1].

These findings clearly show that earliest demonstration of smoke as a stimulant for germination of dormant seeds was reported far back in 1940 by Indian researchers, about 50 years earlier than the report by De Lange and Boucher[5]. This work and discovery from India also assumes importance in the present era of IPR regime, where it is essential to provide credit to the pioneers and document the historical aspects of research.

1. Nelson, D. C., Flematti, G. R., Ghisalberti, E. L., Kingsley, W. D. and Smith, S. M., *Annu. Rev. Plant Biol.*, 2012, **63**, 107–130.
2. Wicklow, D. T., *Ecology*, 1977, **58**, 201–205.
3. Keeley, J. E., Morton, B. A., Pedrosa, A. and Trotter, P., *J. Ecol.*, 1985, **73**, 445–458.
4. Keeley, S. C. and Pizzorno, M., *Am. J. Bot.*, 1986, **73**, 1289–1297.
5. De Lange, J. H. and Boucher, C., *S. Afr. J. Bot.*, 1990, **56**, 700–703.
6. Parija, P., Dixit, P. D. and Challam, G. V., In Proceedings of the 27th Indian Science Congress, Madras, 1940, Indian Science Congress Association, 1941, pp. III 228.
7. Sikder, H. P., *Exp. Agric.*, 1967, **3**, 249–255.
8. Indra, R., Abrol, Y. P. and Bhargava, S. C., *J. Post Grad. School IARI*, 1969, **7**, 81–89.

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RAKESH PANDEY[1,*]
VIJAY PAUL[1]
S. C. BHARGAVA[1]
MALAVIKA DADLANI[2]

[1]*Division of Plant Physiology,*
[2]*Division of Seed Science and Technology,*
Indian Agricultural Research Institute,
New Delhi 110 012, India
**e-mail: rpandey@iari.res.in*

Conservation of bee trees as world heritage sites

Pollinators and pollination are crucial in the functioning of almost all terrestrial ecosystems, including those dominated by agriculture because they are in the frontline of sustainable productivity through plant reproduction. Pollinating insects are declining worldwide, resulting in pollination crisis for (food) crops as well as wild plants and loss of natural biodiversity. Possible drivers for the decline of insect pollinators include habitat loss, intensive land use, pollution including pesticides, loss of genetic diversity in honey bees, detrimental bee keeping practices and climate change. This demands a response from land managers, conservationists and political decision makers to the impending 'global pollinator crisis'. Understanding the causes of pollination failure in plants can aid in the successful conservation and recovery of rare plants, maintenance of crop yields and sustainable use of wild plant resources such as forest timber. Feasible conservation strategies involve efforts to protect or restore plant resources and native pollinators, and setting up protected natural areas, which will ensure food provision, mating and nesting sites for pollinators.

It has been estimated that, worldwide, close to 100 crops are pollinated by honey bees. The global value of animal-mediated pollination is US$ 153 billion. Animal-mediated pollination contributes to the sexual reproduction of over 90% of the approximately 250,000 species of modern angiosperms. This interaction diffusely affects human survival through its roles in sustaining much of the biodiversity on Earth and contributing to the integrity of most terrestrial ecosystems.

The plight of pollinators is causing worldwide concern. Not only are population numbers of many formerly abundant species dwindling, some species are disappearing altogether. Pollinators are a necessity for ecosystems around the globe. Pollination is not only mutually beneficial to the interacting plants and animals, but also serves humanity directly through the yield of many crops, and indirectly by contributing to the healthy functioning of unmanaged terrestrial ecosystems. Without them, the world as we know it would not exist. Despite these facts, we have allowed their populations to decline to alarmingly low levels.

It is encouraging that during the recently concluded Fourth International

Figure 1. ***a***, A view of the bee tree in Ramagovindapura Village. ***b***, Detailed view of colonies on a branch.