even during Śulvasutra period. Ideas of Calculus (e.g. $d(\sin\theta) = \cos\theta\ d\theta$) are germane in Āryabhata's work.

What is wrong in calling Pell's equation as Brahmagupta–Bhāskara equation if the latter have considered these equations earlier to Pell?

It is too much to say that the popularity of Vedic mathematics would endanger mathematics education. Introduction of abstraction in mathematics right from undergraduate level has already killed the subject. It has even been pushed to school level with disastrous consequences. Almost all students, research scholars, teachers and researchers can reel off definitions and theorems but can never construct an example. Mathematics is no more enjoyable as it was found 30, 40 years ago. On the other hand, children do find the algorithms of Vedic mathematics highly enjoyable. They are able to work with them with ease. Which is dangerous: Memory-oriented learning of mathematics without concrete examples or computation with joy? We wish that mathematicians would desist from talking about what they do not know and assess whether they are capable of making what they deem as important, enjoyable and useful.

Finally, T. S. Bhanu Murthy certainly realized that the algorithms of the Tirtha could be mathematically justified while the reviewer speaks about the Tirtha's work without looking into what it is. Let scientists of the country become responsible to the nation and to its youngsters whose future they would spoil otherwise.

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## *C. S. Yogananda replies:*

I stand by my comments regarding Vedic Mathematics of Sri Bharati Krishna Tirtha. My fear of possible negative influence of Vedic Mathematics on education stems from the claims made in that book, and also by its propagandists.

It is ridiculous to equate mathematics with algorithms to facilitate computation. Rangachari's statement that 'In fact, if the Indians had been original and continued the work of their ancestors with their own originality, Indian mathematicians would have challenged the supercomputer... making the entire world look in amazement' is the height of naivety. Mathematics is much more than mere computation. For instance, no supercomputer could have ever made the *Ramanujan Conjecture* or, even less so, proved it!

If, as he says, mathematics is no more enjoyable as it was found 30 or 40 years ago, the mistake does not lie with mathematics! Exciting things are always happening in mathematics. What better example than the recent proof of *Fermat's Last Theorem*!

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# RESEARCH NEWS

# Crucial role of the landscape 'matrix' in determining biodiversity within fragmented habitats

*Neelkamal Rastogi*

Extensive urban and agricultural developments have caused major changes in the landscape patterns. Human activities in the form of commercial and industrial enterprises, construction of residential complexes and network of roads have brought about fragmentation of natural landcover types, such as forests or grasslands. Although all natural landscapes can be considered as mosaics since they are composed of discrete bounded patches of biotic and abiotic structure, human-caused ecological disturbances have played a particularly prominent role in altering the landscape patterns. All landscapes are characterized by a predominant continuous cover type which acts as a 'matrix' in which other patch types appear. For instance in human-dominated landscapes, forest patches may be embedded in a 'matrix' of farm fields or human settlements.

In the mid-1980s, Larry Harris, an ecologist at Florida State University published *The Fragmented Forest*, an influential book which argued that human settlements, especially the roads accompanying it, split natural areas into small isolated pieces which in turn led to ecological impoverishment[1]. In view of the detrimental effect of habitat fragmentation on biological diversity, ecologists in various parts of the world are trying to prevent fragmentation of threatened habitats[1,2]. However, till now it was not exactly clear how the fragmented landscape affected biological diversity. Recent experimental results clearly demonstrate the crucial role of the landscape 'matrix' variables in explaining variation in biodiversity within protected but fragmented habitats[3,4]. Between 1949 and 1987 a

severe decline in the abundance and diversity of forest birds was noted in a Oak forest at a nature reserve in New Jersey, USA[5]. Similar population decline was also observed at eight other sites in eastern USA[5]. One feature common to all these sites was their isolation in relatively small patches of forests surrounded by a 'matrix' of residential areas or farmland. This dramatic decline in forest birds was not found in forests larger than 100 hectares[5,6]. Robinson and coworkers[3] have recently demonstrated that the decline of the forest birds was due to the adverse effects of forest fragmentation on the nesting success of these birds. Fieldwork showed that small fragmented forests are an unfavourable environment for nesting because of loss of eggs and nestlings to predators, such as racoons and feral cats and due to parasitism by cowbirds. An important conclusion that emerges from their study is that small forests are unfavourable for nesting not because of the habitat characteristics of the forest itself but because of the features of the surrounding landscape or the 'matrix'. If the 'matrix' has few nest predators or cowbirds, then nesting success will be similar for large and small forests. On the other hand, if the features of the 'matrix' are such that attract cowbirds, racoons or feral cats, then nesting success will be low. Robinson and coworkers determined nest predation and brood parasitism in nine different landscapes ranging from 90% agricultural to more than 90% forested. They showed that in landscapes fragmented by agricultural fields, levels of nest predation and brood parasitism were so high that population of forest birds in such areas is population 'sink', where reproduction is too low to sustain population. Areas with large forests have low rates of predation and parasitism and therefore serve as population 'sources' which may provide surplus birds to fragmented areas.

In fact, the influence of the 'matrix' can occasionally even override the negative impact of fragmentation. This is seen from the results of the experiments carried out in the Biological Dynamics of Forest Fragment Project (BDFFP) near Manaus, Brazil[4]. The findings from this 10-year long study conducted in the Brazilian Amazon, presented by Mandy Tocher of the University of Canterbury in Christchurch, New Zealand, at the meeting of the Biological Society of America, at Snowbird Utah, USA, (30 July through 3 August 1995) surprised the ecologists since it showed that frogs actually became more diverse after patches of forests were isolated. However, results of other BDFFP experiments showed that there was a well-marked decline in diversity in birds, bees, wasps and beetles after isolation of forest patches. The crucial role of the 'matrix' and its interaction with the ecology of different species is considered to be the most important finding of these experiments. It is suspected that the land outside (pastures, farmland and secondary growth) was permeable to frogs so that isolated fragments were not really fragments as far as frogs were concerned. Thus it appears that in fragmented habitats, the characteristic features of the landscape 'matrix' may be friendly for the species inside the patches, such as those permitting migration of keystone species, or may be hostile, if they promote predators and parasites of the species inhabiting the fragmented habitats.

In view of growing awareness regarding environmental issues and the realization that conservation measures should be focused on threatened habitat types and not just on individual species types[2], this is an important finding. If protected habitats are sliced by roads, human settlements, etc., the result will be fragmented patches of the habitat where conservation still may not work if the patches are too small and the landscape 'matrix' features do not favour the species living within the reserve.

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## SCIENTIFIC CORRESPONDENCE

# Variability in miniplasmids of *Xanthomonas campestris* pv. *malvacearum*

*XANTHOMONAS CAMPESTRIS* pv. *malvacearum* (*Xcm*) is one of the most important bacterial pathogens causing, on an average, yield loss of 20–30% on tetraploid cotton in India. Widespread occurrence of several highly virulent races of the pathogen, in this subcontinent, has thrown several cultivars out of cultivation[1]. Primary infection of seedling originating from internal seed infection is a significant factor in disease epidemiology[2]. Detection and rapid identification of seed-borne inoculum is necessary to develop need-based management practices. The importance of this has become more evident with the increased international movement of germplasm and commercial seed in recent years. The traditional techniques for detection of pathogen are accurate but too slow and generally cannot be applied on a large scale. Recently, plasmid-based detection methods (PCR, DNA-hybridization) are gaining importance as these are not only rapid but also very sensitive (can detect as less as ten bacteria in infected seed)[3–6]. *Xcm* contain plasmids[7,8], and pathogenicity of the most virulent race-32 (neutralizes five blight resistant genes or *B*-genes) was lost in plasmid-cured