been observed that invariably the projected progress for a three year project is not up to the mark vis-à-vis the set time schedule and hence delay in achieving the set objectives. There are a number of other unavoidable circumstances hampering the initiation of the project itself, thereby slowing the pace of progress of the project and meeting the projected objectives in a specific time frame. This has led to a situation wherein the progress of research work in the first year in a number of cases has been negligible. Accordingly, it may be worthwhile to have a directory of the completed projects incorporating various parameters. It may be mentioned that in case of the DST, the project completion report (PCR) submitted by PI includes all the elements referred to by Gopalan including procurement/usage of equipment/ plans for utilizing the equipment facilities in future, summary of achievements and indication of scope for future work as well as financial position of the project. The PCR also highlights S&T benefits accrued including a list of research publications, manpower trained on the project and patents taken, if any. Hence, it is suggested that it may be better if funding agencies bring out annual programmewise directory based on comprehensive information already available in the PCR and make it available on a website to the scientific community.

It would therefore be more appropriate that the funding agencies may annually bring out directory containing: (i) the list of funded projects, cost, etc. so that these programmes are not duplicated, and (ii) a two-page summary of the final completion report of each funded project. The funding agencies may evolve a common format for this purpose which will be filled in by the PI and submitted along with the project completion report as soft and hard copies.

1. Gopalan, K., *Curr. Sci.*, 2009, **96**, 165.

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Endophytes: the real untapped high energy biofuel resource

The burning of fossil fuels keeps enriching the atmosphere with CO_2, one of the principal causes of increased global warming. So, there is a strong interest to find an efficient energy source which can be used as an alternative to gasoline. Many geologists view crude oil and natural gas products arising from the compression and heating of ancient organic substances over the course of geological time. It is also speculated that some hydrocarbons in the earth's upper mantle which may have arisen via fermentation of plant materials by fungi under conditions of limited oxygen could be an alternate fuel source.

Many microbes are known to produce enzymes, vitamins, primary and secondary metabolites and also produce volatiles including low molecular mass hydrocarbons[1,2]. Microbes producing such volatile high energy substances are of extreme general interest. Brazilian ethanol programme is the best example of the efficient use of bioenergy by growing sugarcane[3] which harbours enormous N_2 fixing bacteria in its healthy tissues. These microorganisms called endophytes live inside the plant tissue residing latently or actively, colonizing locally or systematically without showing visible harm to the plant and, in some cases, improving plant growth and reducing disease symptoms caused by several plant pathogens. For instance, the healthy stem of sugarcane colonized by N_2 fixing bacteria like *Glonacetobacter diazotrophicus*, *Herbaspirillum seropidicae* and *H. rubrisalbicans*[4]. Similarly, N_2 fixing *Azospirillum brasilense*, *A. amazonense*, *A. lipiferum* and *H. seropidicae* were isolated from palm trees[5]. The endophytic fungi are well known for production of volatiles including low molecular mass hydrocarbons. A volatile producing endophytic fungi, a mycofumigant *Muscodor albus* was isolated from *Cinnamomum zeylanicum*[6]. NRRL 50072 a strain of *Gliocladium roseum* isolated from Patagonian angiosperm *Eucryphia cordifolia* (ulmo) can produce volatiles with antibiotic properties[7]. This fungus produces many volatile alkanes/alkenes including 4-decene, 9-methyl, 1-octane and 1,3-octadiene along with a plethora of low molecular mass esters, alcohols, ethers and fatty acids[8]. However, due to the slow growth rate of NRRL 50072, it would be difficult to meet the commercial demand at the present stage[9].

All these new findings open a perspectives for the replacement of fossil fuels by bioenergy resources and it would seem that a much larger search for such organisms in our natural environment needs to be launched.

1. McAfee, B. J. and Taylor, A., *Nat. Toxins*, 1999, **7**, 283–303.
2. Strobel, G. A., *J. Indian Microbiol. Biotechnol.*, 2006, **33**, 514–522.
3. Dobereiner, J., Baldani, V. L. D., Olivares, F. L. and Reis, V. M., In *Nitrogen Fixation with Non-legumes* (eds Hegazi, N. A., Fayez, M. and Monib, M.), American University of Cairo Press, Cairo, Egypt, 1994, pp. 395–408.
4. Cavalcante, V. A. and Dobereiner, J., *Plant Soil*, 1988, **108**, 23–31.
5. Magalhães, F. M. and Dobereiner, J., *Microbiologia*, 1984, **15**, 246–252.
6. Worapong, J., Strobel, G. A., Ford, E. J., Li, J. Y., Baird, G. and Hess, W. M., *Mycotaxon*, 2001, **79**, 67–79.
7. Stinson, M., Ezra, D., Hess, W. M., Sears, J. and Strobel, G. A., *Plant Sci.*, 2003, **165**, 913–922.
8. Strobel, G. A. *et al.*, *Microbiology*, 2008, **154**, 3319–3328.
9. Stadler, M. and Schulz, B., *Trends Plant Sci.*, 2009, **23**, 353–355.

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