



Figure 1. Yearly chart of total publications from India and China and contributions of the top research producing organizations.

publishing specifically in journals that the Thomson ISI database includes³. Second, the contribution of the top research producers in India has remained constant at nearly 30% of the total over the entire span of 25 years that is included in this study. This is in contrast to two significant trends that can be observed from the same data from China. First, the data from 1989 to 1997 show an increase from about 45% to 56%. This phase in time is also correlated with a surge in enrolment at the top graduate schools. Interestingly, during most of these years the total publications from China showed only a nearly linear growth. The second significant trend in this data is observed during the years 2000–08 when the contribution of the top research producers decreased from 53% to 39%. It was during these years that much of the expo-

nential growth in the total publications can be observed.

When we study the two sets of data for China together, we arrive at a more complete picture. During the years 1989–97 when the share of the top research producers increased, these institutions were also producing highly trained manpower to populate the other institutions in the country³. Subsequently, during the years 2000–08, the total publications from China grew at an exponential pace whereas their biggest research institutions' contribution decreased. This clearly indicates a trend where the hitherto low and medium productive institutions started to participate in research ventures. This process could occur only because the highly trained manpower produced during the years 1989–97 began participating in advanced research activities. In addition,

this process was also catalysed through a series of policy and incentive schemes targeted at these institutions.

It is well known that India has a large number of low to medium research productivity institutions⁴. It is also known that these institutions owing to the long-running Quebec Education program are now populated by a significant number of doctorate degree holding researchers. If India is to see the growth pattern that China saw during the 2000s within the constraints of India's economic and human resources, it cannot happen without allocating resources specifically to develop research output from these sleeper institutions. The larger research institutions within the country would serve as excellent mentors in this process. The recently constituted Kakodkar commission could study this possibility in the interest of developing research in the country at large.

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Mycological foray: a culture missing in our country

India is one of the 25 biodiversity rich areas and 18 hotspots of the world; the hotspots being the North East Himalayas and Western Ghats¹. India harbours 17,000 plant species with 5725 endemic to this peninsula². But microbial diversity in India and elsewhere is poorly known/documented³.

Fungi/microbes are a source of large number of antibiotics, enzymes, hormones, vitamins, biopesticides and biofertilizers and act as bioindicators of air pollution⁴. Two products which revolutionized the health industry are Penicillin and Taxol⁵, both of which are of fungal origin. The fungi are an integral

part of forest regeneration as 85% of tree species are associated with one or the other form of mycorrhiza⁶. They provide inaccessible nutrients and water and protect roots from diseases/pathogens. They help in tree/forest regeneration and survival and also act as catalysts for mine reclamation. The association of arbuscu-

lar mycorrhizal (AM) fungi with herbaceous plants is an example of obligate mutualistic symbiosis where both partners benefit from the association. The importance of precious, wild and domesticated mushrooms converting agricultural waste to nutritious food⁷ has been appreciated worldwide. The finest quality of wine is grape juice processed with the help of fungus. The Nobel prize winning work (on the fungus *Neurospora sitophila*) based on the 'one-gene one-enzyme' theory is an example of how fungi can play an important role in unfolding secrets/intricacies of life⁸.

Fungi can cause serious diseases in crops⁹, thus hampering production; cause human and animal diseases, spoil timber, textile, paper, food grains, jam, jellies⁴ and wipe-out forests to the level of extinction^{5,9}. But little attention is paid by the funding agencies to the documentation of these fungi/microbes. The funding agencies sponsor workshops, seminars and symposia, but no foray has been organized for the collection of fungi by experienced mycologists. In European countries^{10,11}, about 10–40 mycologists after attending such conferences visit biodiversity-rich sites, collect fungi, share their knowledge in the field, identify their collections, prepare a report and publish in journals. In this way, the experts use their expertise to catalogue the fungi present in a specific unexplored location/site. Sometimes more than one such foray are organized to collect the late fruiting fungi covering a wide diversity of habitats and access the spectrum of fungi of that region. These forays are also an integral part of annual meetings of scientific societies. At times independent forays are arranged

as per season as Autumn foray or Spring foray^{12,13}. In fact, no single person is an expert of all groups of fungi. Hawksworth *et al.*¹⁴ have identified 21 niche experts and in such meetings one can get all experts at one place to share their knowledge/experience. This 'foray culture' is missing in our country's conferences, workshops, seminars, symposia and annual meetings.

Considering the enormous unexplored (>90%) biodiversity of fungi³/microbes and shrinking habitat (due to mindless destruction in the name of economic growth), there is an urgent need to make the foray mandatory for such 'congregations'. Wild mushrooms are being overharvested in the monsoon season, hence these macromycetes are on decline in India as in Europe^{15–17}. Arnold¹⁶ alerted for their judicious harvesting and has even put many fungi in the 'Red List'.

Soil samples should also be collected to study the soil fungi in that region as thousands of tonnes of soil are lost due to floods every year, leading to extinction of novel/useful fungi.

Thus, organizers of conferences, symposia and seminars should include and facilitate foray in their programmes as mandatory 'field scientific activity'. Fungi/microbes should be saved from extinction before it is too late.

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