

Plant Pathology in India:

Vision 2030



Indian Phytopathological Society

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Indian Agricultural Research Institute
New Delhi 110 012

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SECRETARY & DIRECTOR GENERAL

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FOREWORD

It is a pleasure to know that the Indian Phytopathological Society (IPS), New Delhi is organizing a Brain Storming session on "**Plant Pathology in India: Vision 2030**" at University of Hyderabad, Hyderabad on December 02, 2011 during its 64th Annual Meeting and National Symposium on "Biology of Infection, Immunity and Disease Control in Pathogen-Plant Interactions".

The knowledge of people and events that shaped our science allows us to place current accomplishments in perspective and helps us to appreciate the great strides made by our scientific forefathers. Plant pathology will be a global and integrated discipline that will develop and apply the fundamentals of plant-microbe interactions to advance plant health and productivity in coming future. With the advent of newer technologies in the area of diagnostics, genomics, transgenic etc., is appropriate to do SWOT analysis and develop a vision for the country.

I appreciate the efforts and valuable contributions provided by the various plant pathologists from all over India and the Society in developing the document on "Plant Pathology in India: Vision 2030" and hope that the Society will achieve the targets set in the document to make the Indian agriculture locally, regionally and globally competitive. It is expected that the document will also prove useful for the students, researchers, policymakers and stakeholders to address the future challenges for growth and development of the agricultural sector and ensure food and income security.

I wish the Brain Storming Session on "Plant Pathology in India: Vision 2030" a grand success.

(S. AYYAPPAN)

MESSAGE

With the changing priorities of Agricultural research and education in India, the subject of Plant Pathology also needs to be addressed so as to meet the challenges of 21st Century. We really need to look and revisit the subject and foresee so that the coming generation is ready with the solutions and this can be only achieved with the concerted efforts of the Plant Pathology experts working on different aspects. Indian Phytopathological society (IPS) has taken right step in this direction by bringing out a compilation "Plant Pathology in India: Vision 2030." It is indeed a valuable publication encompassing a wide range of the subjects ranging from ancient history, important diseases of crops, molecular diagnostics, biological control, transgenic, disease management etc. I appreciate the efforts of the Society for the timely publication. My best wishes to all for a grand success of Brain Storming session on "Plant Pathology in India: Vision 2030".



(R.K. JAIN)

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PREFACE

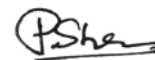
The Indian Phytopathological Society (IPS) is a professional forum for promoting the cause of Phytopathology. It is the third largest society of plant pathologists in the world. The Society was established in February 28, 1947 at the Indian Agricultural Research Institute, New Delhi by Dr. B.B. Mundkur, an eminent Plant Pathologist. The Society is an international scientific organization devoted to the study of plant diseases and their control. The Society provides information on the latest developments and research advances in plant health science through its journals and participates in the exchange of plant health information with public policy makers, and the larger scientific community; and provides opportunities for scientific communication, collaboration, and professional development.

Indian agriculture registered a phenomenal growth in the recent past mainly due to development of varieties resistant to pathogen and adoption of latest plant protection measures. A lot more need to be done to sustain the momentum gained. In this context, the contribution of the Society in bringing to focus the area of research on diverse aspects of plant pathogen is invaluable. Advanced techniques for rapid, reliable and specific detection and characterization of pathogen is promoted. Identification of resistance genes and their source, development of molecular markers for resistance, environmental health by promoting bio-control agents and growth promoting bacteria and transgenic resistance as well as host-pathogen interaction are some of the issues, IPS through its various activities trying to crystallize the concepts and its implications in future. In the new millennium IPS will co-ordinate and will provide impetus to amalgamation of molecular plant pathology and the practical plant pathology to mitigate the disease losses. It is expected that in the foreseeable future, a knowledge-based economy will provide the platform to sustain a rapid rate of economic growth to achieve the objectives. IPS shall remain committed to its core competencies within chemical, biochemical and biotechnological crop disease management to coexist in the future.

The Indian Phytopathological Society (IPS) recognizes the need to look to the future to best position the discipline to meet future societal needs and scientific opportunities.

In this document, a vision for the future of plant pathology has been described that must be pursued and supported for sustainable production of healthy plants upon which life itself depends.

I would like to place on records the suggestions made by Dr S. Ayyappan, Secretary, DARE and Director-General, ICAR and Dr. T.P. Rajendran, ADG (Plant Protection) in making the document relevant and useful one.



(PRATIBHA SHARMA)

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PREAMBLE

Historically, Plant Pathology of India is quite ancient as the Indian agriculture, which is nearly 4000 years old. This confirms that mention about plant diseases was made much before the time of Theophrastus. The events of the development of Plant Pathology in India have great signpost. Plant diseases, other enemies of plants and methods of their control had been recorded in the ancient books viz., *Rigveda*, *Atharva Veda* (1500-500 BC), *Artha Shastra* of Kautilya (321-186 BC), *Sushruta Samhita* (200-500AD), *Vishnu Purana* (500 AD), *Agnipurana* (500-700 AD), *Vishnudharmottara* (500-700 AD) etc. During 11th century, Surapal wrote *Vraksha Ayurveda*, which is the first book in India where he gave detail account on plant diseases and their control. Plant diseases were grouped into two-internal and external. Tree surgery, hygiene protective covering with paste, use of honey, plant extracts, oil cakes of Mustard, Castor, Sesamum etc. are some of the disease management practices recorded in the book. Symptoms of plant diseases are cited in other ancient Indian literatures viz. *Jataka* of Buddhism, *Raghuvamsha* of Kalidas etc.

Plant Pathology is composed of many other disciplines such as botany, mycology, microbiology, bacteriology, virology, nematology, meteorology, biochemistry, genetics, soil science, horticulture, agronomy and forestry. Plant pathology encompasses the study of what causes a plant disease; how a pathogen attacks the plant at the molecular, cellular, tissue, and whole plant levels of organization; the host response to attack; dissemination of pathogens: influence of environment; management of plant pathogens and thereby reduce the effects of the disease on plant populations. Unlike physicians or veterinarians, who emphasize treatment of individuals, plant pathologists are usually interested in populations of plants and not individuals. Some plant pathologists spend most of their time in the field studying how pathogens move over a large area and what environmental factors play a role in development of epidemics or determining which management tactics are most effective in controlling or reducing the impact of a disease. Other plant pathologists are interested in the processes by which a pathogen induces a disease or may look for genes that confer resistance in a plant and complete most of their professional activities in a laboratory.

In the pre DNA era of plant pathology studies have gone through many phases where numerous conventional markers were used for detection, identification, quantification of pathogen species and for evaluation of the genetic variation at either individual, population, species level. These methods include diagnostics methods such as disease symptoms, isolation and culturing of the microorganism and their identification through morphological and physiological traits. Moreover, the pathotypic analysis such as virulence and aggressiveness have been the characters most often used for genetic studies of plant pathogens and have provided a clear picture of race diversity and distribution, however, it does not allow the evolutionary relationships among pathotypes to be discerned. On the other hand, the morphological characters and physiological tests are costly and time consuming. These markers were also not considered reliable because they are instable and usually vary with the environment. Over the years, solutions were however found to

avoid some of these problems by using markers biochemical traits such as proteins and isozymes. These markers have already been used for various purposes in plant pathology including fingerprinting, genetic diversity and taxonomy.

Changes in climate, namely temperature fluctuations, have influenced the agriculture and forestry industries, pests and diseases routinely lower production and quality despite significant gains in the development of improved plant varieties and farming practices. How the adaptive capacity of agriculture and forestry industries would be affected by shifting disease dynamics resulting from the changing climate is worthy of consideration for social, economic and political reasons. Fingerprints of global change on pathogen and disease dynamics should be the immediate strategies to be developed. There are numerous disease-forecasting models that use short-term weather data for tactical disease management, but very few models/studies link disease prevalence or severity to long-term climate data.

The present era is of microbes including viruses, fungal pathogens, endophytes (fungi), mycorrhizae (fungi), bacteria and various interactions. Capitalization of beneficial, symbiotic relationships to produce plants that are more heat tolerant, drought tolerant or self-sufficient. Disease management is another branch where Plant Pathologist is directly related as a Plant Doctor, who is nowhere less than a medical Doctor and Veterinarian. To practice in field is a challenging job. There is a great scope of it since, we have labs employed for IPM, IDM, Biocontrol, resistance, cultural practices, chemicals and an integrated prescription will help a farmer to manage crop disease problems. Plant Pathology offers a great scope of research, product development, teaching, extension and with combination of other subjects a fleet of private or public practitioners of plant health management can be created. This status has to be recognized and the course curricula strengthened so that the employment opportunities can be enhanced. Compilation of Plant Pathology-Vision 2030 is an attempt to integrate known experts of the country to express and highlight their views on various pathological problems.