diagnosis. Range of symptoms by different strains of virus on different rice cultivars has been described. Symptoms induced by feeding vector leafhoppers are also given (chapter 3). The management strategy depends upon yield loss. Though yield reduction on different varieties has been given yield loss per unit area is not provided (chapter 4).

For many years the cause of the disease was not known. Rice tungro is caused by bacilliform particles of 25 × 140 nm and spherical particles of 28–30 nm in diameter. Antisera has been raised against both the particles of tungro virus. This is most useful in the detection and epidemiology. Various diagnostic techniques have been described in chapters 5 and 6.

Molecular biology of tungro virus is most interesting because of two viruses; RNA virus and DNA virus associated in causing the disease. Only limited information is available on this (chapter 7). Existence of several strains of RTV (RTV 1, RTV 2, RTV 2A, RTV 2B, RTV 3, RTV 4) in different rice-growing areas has been described (chapter 8). Little attention has been paid to the metabolic processes associated with the symptom development of rice plants infected with tungro viruses despite its widespread occurrence and economic importance (chapter 9).

Tungro viruses are transmitted by various species of *Nephotettix*. The authors have described vector distribution, virus–vector relationships, biology, host range and vector movement (chapters 10–12). The epidemiology of tungro disease is interesting because of the involvement of insect vector, besides host (rice), pathogen (RTSV & RTBV) and environment. Presence of virus strains, vector biotypes, multiple rice cultivars, alternate weed hosts and different cultural practices make tungro epidemiology very interactive and disease development becomes a function of various aspects of virus, host, agronomic practices and materiological factors (chapter 13). Tungro viruses, their transmission, virus–vector relationship, vector biology, population dynamics of the vector and host resistance have been discussed (chapters 10–13). Various ways and means have been attempted and different recommendations have been made in different Asian countries to reduce the disease incidence and increase the crop yields (chapter 14). Varietal resistance has been discussed in a separate chapter (chapter 15). An interesting aspect is a note for farmers and extension workers provided in the book (chapter 17), besides future prospects (chapter 18). All the literature published on rice tungro is provided in the book (chapter 19) and subject index is given for easy reference.

The book is an outstanding contribution with application of data, diagrams and illustrations. I hope it will be useful to plant pathologists, plant virologists, entomologists, extension workers and students and teachers of general agriculture.

V. MUNIYAPPA

Department of Plant Pathology, University of Agricultural Sciences, GKVK, Bangalore 560 065, India

---

Bacterial Pathogenesis of Plants and Animals: Molecular and Cellular Mechanisms. J. L. Dangl, ed. Current Topics in Microbiology and Immunology series, Springer-Verlag, Berlin, Heidelberg. 1994. Vol. 192. 343 pp.

Although four highly authoritative books (*Molecular Basis of Bacterial Pathogenesis* eds Barbara H. Iglewski and Virginia L. Clark); *Molecular Biology of Bacterial Infection: Current Status and Future Perspectives* (eds Hormaeche, C. E., Penn, C. W. and Smyth, C. J.); *Bacterial Pathogenesis: A Molecular Approach* (eds Abigail A. Salyers and Dixie D. Whitt); *Molecular Genetics of Bacterial Pathogenesis* (eds Miller, V. L., Kaper, J. B., Portnoy, D. A. and Isberg, R. R.). For reviews see *Curr. Sci.*, 1993, **64**, 118–119; 1993, **65**, 798–799; 1995, **68**, 343–344; 1995, **69**, 624–625) have already appeared on the molecular underpinnings of bacterial pathogenesis, the slant of this volume is entirely different. This is apparent, at the outset, from the somewhat non-obvious choice of topics which include both plant and animal pathogens. The objective of this volume is to bring out the commonalty of molecular mechanisms which underlie bacterial pathogenicity, irrespective of the type of the pathogens – plant or animal, and thus underscore the importance of basic research approaches to parallel problems in pathogenesis.

The first basic concept about bacterial pathogenesis, whether plant or animal, which one realizes while going through this volume is the multiplicity of virulence factors required. Beattie and Lindow discuss various virulence factors which determine the epiphytic fitness of phytopathogenic bacteria. This is analogous to attachment and colonization of host surfaces by the animal pathogens as detailed by Meyer *et al.* and Manning in their reviews on the pathogenicity of *Neisseria* spp. and *Vibrio cholerae* respectively. From these reviews, it is evident that while not much is known as to the molecular mechanisms underlying various virulence factors, viz. fimbrial adhesions, extracellular polysaccharides (EPS), osmotolerance, tolerance to UV and visible radiations, etc. determining the epiphytic fitness of phytopathogenic bacteria, detailed information is available on the molecular genetics of colonization factors of animal pathogens such as Tcp (*t*oxin *c*oregulated *p*ilus) and Acf (*a*ccessory *c*olonization *f*actor) of *Vibrio cholerae*, and pili and opa (*op*acity *a*ssociated) proteins of *Neisseria* spp.

The next basic concept which one realizes is the complexity of genetic regulatory pathways controlling expression of virulence determinants in bacterial pathogens. Dow and Daniels discuss global regulation of virulence determinants, viz. extracellular enzymes (cellulase, protease, polygalacuronase lyase, amylase and lipase), EPS, xanthan, etc. of *Xanthomonas campestris* pv. *campestris*. This is a clear reflection, among animal pathogens, of *bvg* locus of *Bordetella pertussis* as detailed by Rappouli. The review by Dow and Daniels also shows that environmental modulation of virulence determinants in phytopathogenic bacteria, as is well known for the animal pathogens, is also regulated by two-component signal transduction mechanisms. The existence of two-component regulatory systems in phytopathogenic bacteria is further corroborated by studies on the genetic and chemical bases of recognition in *Agrobacterium tumefaciens* as reviewed by Binus and Howitz.

The extracellular products produced by both animal and plant bacterial pathogens represent a group of 'most obvious' virulence determinants. Collmer and Bauer, choosing two quite different plant pathogens namely *Erwinia chrysanthemi* and *Pseudomonas syringae*, discuss the molecular genetics of extracellular virulence proteins. In doing so the authors put maceration, pectic enzymes and *pel* genes *vis-a-vis* hyper-

sensitive response (HR), hairpins and *hrp* genes. The concluding section of this review is very interesting in which the authors compare pathogenicity of *Erwinia chrysanthemi* with that of *Pseudomonas aeruginosa* and *P. syringae* with *Yersinia pestis* (reviewed in this volume by Cornelis), thus bringing out similarities/dissimilarities in the deployment and functions of their extracellular virulence proteins. The review by Cornelis is a detailed account of the molecular genetics of yops, the extracellular virulence proteins produced by *Yersinia pestis*.

An extensive review by Bonas discusses structural organization and functions of *hrp* (*h*ypersensitive *r*eaction and *p*athogenicity) genes and *hrp*-dependent secretion of hypersensitive response-inducing proteins (hairpins) in *Erwinia amylovora* and *Pseudomonas syringae* pv. *syringae*. Among the animal pathogens this system can be compared, in the larger perspective, to a number of virulence genes of *salmonella* (reviewed by Finlay). The various genes of *Salmonella* which are under intensive investigation are: *Spv* (*S*almonella *p*lasmid *v*irulence) *Spa* (*S*almonella *p*resentation of *a*ntigen) and *pag* (*Pho-P a*ctivating *g*enes).

The commonalty of the molecular and cellular mechanisms among bacterial pathogens producing quite different clinical disease entities is illustrated by the study of *Shigella flexneri* and *Listeria monocytogenes* as reviewed by Parrot and Sheehan *et al.* respectively. Although quite different as to the clinical disease produced, these pathogens show several similarities in their cytoplasmic multiplication, actin-based movements and cell-to-cell spread.

In a detailed review entitled 'enigmatic avirulence genes of phytopathogenic bacteria' Dangl discusses whatever little is known about the organization, regulation and virulence functions of avirulence (*avr*) genes, bringing into focus some of the paradoxical issues of the topic and posing several questions which must be explored further to understand their exact role in pathogenesis.

A very important question which emerges from the foregoing discussion is: taking cues from animal pathogens, where molecular genetics of pathogenicity are decidedly better understood, can we address ourselves to some of the hitherto unsolved issues of plant pathogens or even vice-versa? This question has been posed more convincingly by McKhann and Hirch in their review on *Rhizobium*. Arguing from several points of view the authors show that there are important conceptual differences between symbiotic and plant pathogen interactions and suggest that *Rhizobium*-legume symbiosis cannot be regarded as a modified or refined type of plant pathogen interaction as proposed by some investigators sometimes back. They further suggest that to understand root hair invasion by rhizobia we should, perhaps, look into models representing invasion of mammalian cells by bacterial pathogens.

The objective of this intellectually stimulating volume is to make the readers view bacterial pathogenicity from newer perspectives. Seen in this context, the volume in its totality is a laudable attempt and a novel addition to works already available on the subject. However some of the reviews, when seen individually, tend to look aloof and wanting in overall objectives of the compilation. This apart each review, whether dealing with plant or animal pathogens, gives detailed information on the molecular and cellular mechanisms underlying the bacterial pathogen discussed. Each review has been provided with an extensive and up-to-date bibliography.

This volume is strongly recommended as part of any collection of books dealing with microbiology. The volume will be of much use to researchers studying various aspects of the molecular genetics of bacterial pathogens and to teachers engaged in teaching advanced level courses on bacteriology plant or animal bacterial pathogenesis and infectious diseases.

J. S. VIRDI

Department of Microbiology,
University of Delhi South Campus,
Benito Juarez Road,
New Delhi 110 021, India

Erratum

Pioneers of ozone study bag chemistry Nobel

S. Parthiban

[*Curr. Sci,*. 1995, **69**, 793–797]

The photographs of Rowland and Molina were inadvertently interchanged. The error is regretted.

– Editors

Edited and published by Prof. S Ramasheshan and Prof. P. Balaram, Current Science Association, Bangalore 560 080
Typeset by WINTECS, Bangalore 560 021, Printed at Printek Printers, Bangalore (3357763)