



Taxonomy of MYCOTOXIGENIC FUNGI

S. Girisham
V. Koteswara Rao
S.M. Reddy



Taxonomy of Mycotoxigenic Fungi

S. Girisham

V. Koteswara Rao

S.M. Reddy

Department of Microbiology
Kakatiya University
Warangal-506009, Telangana



Published by:

SCIENTIFIC PUBLISHERS (INDIA)

Jodhpur

—

5 A, New Pali Road

P.O. Box 91

Jodhpur - 342 001

INDIA

Delhi

—

4806/24, Ansari Road

Daryaganj

New Delhi - 110 002

INDIA

E-mail: info@scientificpub.com

Website: www.scientificpub.com

© 2016, Authors

All rights reserved. No part of this publication or the information contained herein may be reproduced, adapted, abridged, translated, stored in a retrieval system, computer system, photographic or other systems or transmitted in any form or by any means, electronic, mechanical, by photocopying, recording or otherwise, without written prior permission from the authors.

Disclaimer: Whereas every effort has been made to avoid errors and omissions, this publication is being sold on the understanding that neither the editors (or authors) nor the publishers nor the printers would be liable in any manner to any person either for an error or for an omission in this publication, or for any action to be taken on the basis of this work. Any inadvertent discrepancy noted may be brought to the attention of the publishers, for rectifying it in future editions, if published.

ISBN: 978-81-7233-986-9

ISBN: 978-93-86102-23-2

Printed in India

Preface

Mycotoxins are extremely toxic chemical substances produced by certain moulds growing naturally in many agricultural commodities especially cereals and oil seeds both in the field and as well as in storage and later when processed into food and feed concentrations. These toxins are toxic to warm blooded animals including man. Infact term mycotoxin is a misnomer as the etymological meaning is toxic to fungi by analogy to zootoxins and phytotoxins which are toxic to animals and plants respectively. Though human mycotoxicoses are less well understood, they are increasingly diagnosed and studied. Human intake of these toxins mainly occurs from plant based food and animal-derived foods such as milk, cheese and certain meat products. Mycotoxins are in general low molecular weight, non-antigenic fungal secondary metabolites formed by way of several metabolic pathways and still some mycotoxins are derived from a combination of two or more of the principle pathways.

Though wide varieties of mycotoxins are elaborated their number may range more than 300 which are elaborated by not more than 100-150 fungal species. The potential of mycotoxin production is complex and needs to be studied in depth in the literature as there are multimode number of fungi. This is mainly due to misidentification. The gap between mycologists and toxicologists is increasing.

In view of their pleomorphic nature or large production of spores, it is becoming difficult to make proper identification of mycotoxin producing fungi. Most of the times the toxigenic moulds are misidentified. The concept of mycological identification is fast changing as a result only trained mycologist are in a position to make correct identification. Most of the times, identification of mycotoxin producing fungi is critical in the diagnosis of mycotoxicosis. Global concern is given to the mycotoxin contamination of food products. Numerous activities at National, Regional and International levels have been carried out in order to prevent mycotoxin monitor and control mycotoxin contamination, and to train various staff involved in research prevention, *surveillance*, and control activities in both public and private sectors. The present authors have studied these fungi for more than 20 years with in depth knowledge on different features of these fungi. Such manuals for identification of these fungi are also not available.

Detailed aspects of identification have been discussed. It is profusely illustrated which would facilitate easy identification. A key is also provided to make it easy for correct identification. An attempt has also been made to refer the recent nomenclature.

The authors would like to thank to all those who helped directly or indirectly to successfully complete the herculean task. We thank Head Department of Microbiology and authors for providing necessary encouragement. We are also thankful to UGC for financial assistance.

S. Girisham
V. Koteswara Rao
S.M. Reddy

April, 2016

Contents

Chapter 1	Introduction	1-17
	1.1.(i) General Introduction	1
	1.2. (ii) Key to the identification of mycotoxin producing fungi	6
	1.3. (iii) Figures of Mycotoxigenic Fungi	12
Chapter 2	Isolation and detection of mycotoxigenic fungi	18-35
	2.1. Mycological Examination of Foods	19
	2.2. Sample Preparation	19
	2.3. Methods and Media for Isolation of Xerophilic Fungi	20
	2.4. Taxonomy of Food Spoilage Fungi	26
	2.5. Culture Collections and their Importance in Mycotoxin Research	30
	2.5.1. Methods of Metabolic Activity Maintained Fungal Cultures	33
	2.5.2. Methods of Metabolically Inactive Fungal Cultures	33
	2.6. Importance of Culture Collections for Research on Mycotoxigenic Fungi of Stored Products	33
	2.7. Culture Collection and Developing Countries	34
Chapter 3:	Description of Various Mycotoxigenic Fungi	36-238
	1. <i>Acremonium</i>	36
	2. <i>Alternaria</i>	37
	3. <i>Arthrinium</i>	46
	4. <i>Ascochyta</i>	49
	5. <i>Aspergillus</i>	50
	6. <i>Beauveria</i>	91
	7. <i>Bipolaris</i>	92
	8. <i>Byssochlamys</i>	94
	9. <i>Ceratocystis</i>	95
	10. <i>Chalara</i>	96
	11. <i>Chaetomium</i>	97

12. <i>Cladosporium</i>	106
13. <i>Clavariopsis</i>	109
14. <i>Claviceps</i>	110
15. <i>Colletotrichum</i>	113
16. <i>Curvularia</i>	113
17. <i>Cylindrocarpon</i>	116
18. <i>Dendrodochium</i>	117
19. <i>Diaporthe</i>	118
20. <i>Diplodia</i>	119
21. <i>Dichotomomyces</i>	121
22. <i>Drechslera</i>	122
23. <i>Dematophora</i>	124
24. <i>Epichloe</i>	125
25. <i>Epicoccum</i>	127
26. <i>Fusarium</i>	128
27. <i>Fusicoccum</i>	150
28. <i>Gerlachia</i>	150
29. <i>Gibberella</i>	151
30. <i>Gliocladium</i>	152
31. <i>Gloeotinia</i>	153
32. <i>Hormiscium</i>	154
33. <i>Hyalodendron</i>	155
34. <i>Lasiodiplodia</i>	155
35. <i>Metarrhizium</i>	157
36. <i>Microdochium</i>	158
37. <i>Magnaparthe</i>	159
38. <i>Monographella</i>	160
39. <i>Myrothecium</i>	161
40. <i>Nigrospora</i>	165
41. <i>Paecilomyces</i>	168
42. <i>Papulaspora</i>	170
43. <i>Penicillium</i>	171
44. <i>Periconia</i>	202
45. <i>Pestalotiopsis</i>	203
46. <i>Phoma</i>	204
47. <i>Phomopsis</i>	205
48. <i>Piricauda</i>	207

49. <i>Pithomyces</i>	208	
50. <i>Pteroconium</i>	210	
51. <i>Pyricularia</i>	212	
52. <i>Rosellinia</i>	214	
53. <i>Sclerotinia</i>	215	
54. <i>Sepedonium</i>	217	
55. <i>Stachybotrys</i>	218	
56. <i>Sphacilia</i>	220	
57. <i>Talaromyces</i>	221	
58. <i>Thanatephorerus</i>	222	
59. <i>Thielavia</i>	223	
60. <i>Torulopsis</i>	225	
61. <i>Trichoderma</i>	227	
62. <i>Trichothecium</i>	233	
63. <i>Verticillium</i>	234	
64. <i>Verticimonosporium</i>	235	
65. <i>Zygosporium</i>	236	
Chapter 4	Molecular Detection of Mycotoxigenic Fungi and Mycotoxins	239-266
4. 1.	Introduction	239
4.2.	Biosynthetic Gene Clusters	242
4.3.	Molecular Markers for Fungal Complex Genetic Analyses	242
4.4.	Polymerase Chain Reaction (PCR) in Detection of Mycotoxigenic species	243
4.5.	Single-Strand Conformation Polymorphism (SSCP)	244
4.6.	Randomly Amplified Polymorphic DNA (RAPD)	245
4.7.	Amplified Fragment Length Polymorphism (AFLP)	245
4.8.	Molecular Detection of Different Mycotoxins in Foods and Feeds	246
Chapter 5	Pleomorphism in Mycotoxigenic Fungi	267-281
5.1.	Pleomorphism with Conidia of the same Ontogenic Type	273
5.2.	Pleomorphism with Conidia of different types	279
5.3.	Pleomorphism of Conidiomata	279
5.4.	Sequence of States	280
5.5.	Pleomorphism and Classification	281
5.6.	Pleomorphism and Nomenclature	281

Chapter 6	Ecology of Mycotoxigenic Fungi	282-288
	6.1. Effect of Physical factors	284
	6.2. Effect of Chemical factors	286
	6.3. Influence of Biological factors	286
	Glossary	289-294
	List of Mycotoxigenic Species	295-297
	References	298-317