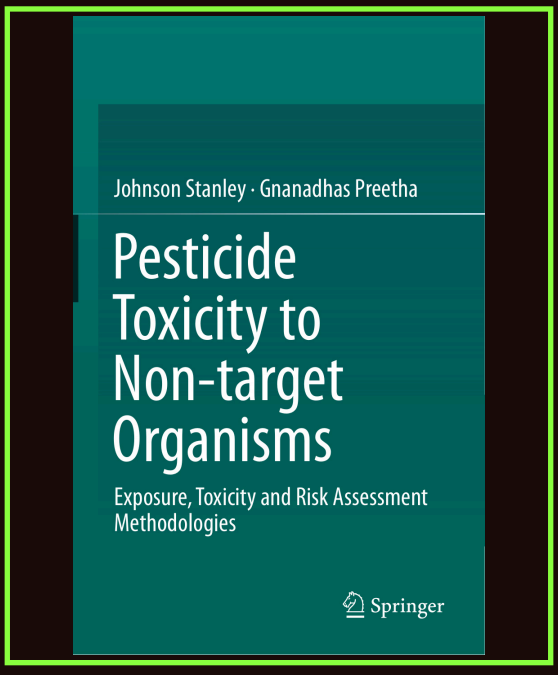
Organisms Exposure, Toxicity and Risk Assessment Methodologies



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Johnson Stanley · Gnanadhas Preetha

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Foreword

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Pesticide toxicology as a whole is comparatively an advanced science especially of the residue analysis but the subject of pesticide toxicity assessment still lags behind. Though there are many studies reporting non-target pesticide toxicity, things are somehow unorganized to arrive at with proper conclusions. This is because of the variations in the results of toxicity testing apparently due to the use of different

methodologies by different scientists. At this juncture, this book comes as a compilation of different methods available for lethal and sublethal toxicity assessment to facilitate the researchers to have a choice of methods so as the best and most relevant ones can be used. The book is broadly divided as toxicity in plants comprising of predators, parasitoids, pollinators and silkworm; toxicity in soil with microorganisms and earthworms; and toxicity in water with fish as a representative organism, covering all the important non-target organisms in agro-ecosystem.

The introduction on the importance of the organism/group in all the seven chapters itself is quite informative. A small subchapter about the routes where these non-target organisms are exposed to pesticides is interesting because of some unconventional routes where in the pollinators (bees) exposed to pesticides through guttation drops, small puddle water in the field and dust from pneumatic sowing machines while sowing of treated seeds; volatilization and adsorption of pesticides in mulberry leaves to silkworms, dumping of obsolete pesticides in soil and leaf fall from pesticide treated plants to microbes and earthworms, etc. A detailed review on the lethal and sublethal toxic effects on the non-target organisms was made available along with different methods available to evaluate pesticide toxicity. A compiled report on risk assessment methodologies and especially the one which is detailed for assessing pesticide toxicity to some non-target organisms reveals the knowledge of the authors in this aspect. I hope this book will be a boon for all who are interested in pesticide toxicity studies both as researchers and students to enrich their knowledge in the subject of toxicity evaluation along with risk assessment methods.



(S. CHANDRASEKARAN)

Foreword

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Pesticides play an integral part in agriculture and most of the farming community relies on it as an easy, efficient and quick pest management strategy. The use of pesticides is accompanied by a variety of undesirable environmental effects. The environmental problems encountered in India owing to large-scale use of pesticides are the insecticide resistance, resurgence, adverse effect on non-target organisms,

presence of pesticide residues in food commodities and persistence in soil, water and air. Nature favours the sustenance of many beneficial organisms which play different roles in crop production. So if anything affects the natural ecosystem equilibrium should be tested properly before use. Hazardous effects of pesticides on non-targets were realized long before and the Rachel Carson's "Silent Spring" published in 1962 has made the public get aware of it. Much emphasis was made later to test verify the toxic effects of the pesticides on non-target organisms even before its widespread usage in the agro-ecosystem and at the time of registration.

Pesticide toxicity to non-target organism is not a new issue to be discussed and plenty of literatures are available. But different researchers use different methods and thus the results are variable even with the same pesticide to a particular test organism. So a proper and uniform methodology is the need of the hour. In this juncture, it is praiseworthy to have a book comprising of different methodologies for testing pesticide toxicity to different non-target organisms of agro-ecosystem. The authors have included different kinds of non-target organisms present in crops ecosystem like predators, parasitoids, pollinators and beneficial insects like silkworms, earthworms and microorganisms of soil ecosystem and fishes as a representative organism for aquatic ecosystem.

This book highlights the importance of non-target organisms, effects of pesticides on them, mode of exposure, toxicity bioassay methods and risk assessment of pesticides on non-target organisms. This book also appears to be a utility guide for researchers, teachers and students to have knowledge on different methods available and to select a suitable, more realistic and ecologically relevant method to conduct their research experiments on different aspects of non-target toxicity. If a suitable method is used for assessing the pesticide toxicity, the pesticides are properly screened and a selective one can be used in our cropping system with less harmful effects on non-target organisms. The proposed risk assessment methodologies wherever not available can also be tried and test verified in future to have a proper risk assessment procedure.

I take this opportunity to congratulate the authors, J. Stanley and G. Preetha (my students), for their strenuous efforts in bringing out this book, which would be a guiding tool useful to students and scientists in their future research.



(T.MANOHARAN)

Preface

Agro-ecosystem consists of plants, soil and water as its main component. Pesticides sprayed on plants affect the plants and its target pest species besides affecting the bio-control agents (predators and parasitoids), pollinators and other beneficial organisms. When pesticides are applied in the soil or get into the soil as spray drift, it affects soil-dwelling organisms like microbes and macro organisms including earthworms. Likewise aquatic pesticides or pesticides accidentally or inadvertently get into the aquatic ecosystem affects many non-target organisms including fish. Thus, the seven chapters of this book deals with the above said organisms individually and in detail.

Voluminous literatures are already available on non-target effects of pesticides. While reviewing the literature, we felt that different methods are used to evaluate the non-target toxicity of pesticides and some methods have no relation between them to enable us to correlate and have a proper comparison or interpretation. Even the median lethal doses/concentrations reported are very different and difficult to compare if the data obtained are from different methods. Moreover, a compilation of different methods is necessary to give the researchers to choose the proper and suitable method of relevance to be used. So the purpose of this book is to compile and present the different methods of pesticide toxicity with its merits and demerits. There are many studies on the lethal toxicity of pesticides but sublethal toxicity studies are generally ignored especially in higher tiers viz., semi-field and field conditions because of its difficulty in evaluating, analyzing and interpreting. So a careful inclusion of sublethal toxic effects and methods to evaluate sublethal toxicity are made available. Laboratory studies on toxicity of pesticides are mostly done by estimating the median lethal concentrations or dose with some exceptional studies on field recommended/realistic dose. The missing link is the comparison of toxic doses/concentrations with the field realistic concentrations. Field recommended dose is the dose in which the pest and non-target organisms actually get exposed in the field. So, the effect on field dose or the comparison with field dose by means of risk estimates will give the actual field effect. Risk assessment is a holistic approach by which one can get the overall toxicity of the pesticide to the non-target organism which is studied upon. Many different risk assessment procedures are described in