Seed Physiology Research

种子生理研究

郑光华 主编

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内 容 简 介

本书是一本很有特色的种子生理学著作，也是一部种子生理研究工作的总结与成果汇编。本书全面而系统地反映出中国科学院植物研究所种子生理研究组在将近半个世纪里取得的成绩与重要进展。全书共分：综论，种子生命力的控制，种子超干燥贮藏，种子休眠与萌发，种子吸胀冷害与渗透调控及种子活力与生活力六篇；并着重突出有关种子超干燥贮藏保存种质，种子吸胀冷害与渗透调控和种子活力等内容，这是当今种子生理学的新兴热点，体现其在关键理论和技术上的突破进展。本书将有助于种子生理学、种子学及其他相关学科领域的理论与技术创新。

本书可供种子科技工作者特别是从事种子生理研究和种子检验工作者参考，也可供植物学专业的教学工作者和科技工作者参考。

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序

种子生理学既是农林学科中的一个重要分支，同时又属植物生理学中的发育生理和代谢生理范畴，而且当前作为种子生理学极为重要领域的种质保存问题又涉及到遗传学、生物化学和保护生物学的内容，正因其具有学科的多重性，彼此间的交叉与渗透，既推动了种子生理学的本身，也有助于促进相关学科的发展。光敏色素的发现实为一例，其意义和作用影响已不限于生菜种子感光萌发和种子休眠机理的重大突破上，而且已波及到植物生理学乃至生物学的若干领域。鉴于种子是农业生产之本，种子质量优劣直接关系到植物栽培的成败和生产的效益，种子种质的长期保存又是密切关系到子孙后代的百年大计，尤其当今人类正面临紧迫保护生物多样性的严峻挑战，种子生理的研究也就日益显得更为重要，这是必然的趋势。

我所郑光华同志主持的种子生理研究组立足于植物园，结合国情实际，在种子生理学的诸多领域，深入开展了系列研究，坚持努力数十年，已取得了很多成绩，在一些关键性的理论和技术上有所突破，并已形成其独自的特色，已反映于此系列论著之中。我认为该书对种子科技及有关工作者能有借鉴之用，并希望它有助于促进我国种子科技事业及种子生理学科的发展。

汤佩松

1995 年 3 月

Preface

Seed physiology not only is an important branch of agronomy and forestry science, but also belongs to the field of developmental and metabolic physiology of plant science. Further more, germplasm preservation, as the most important part of seed physiology today, involves genetics, biochemistry and conservation biology. Because of its multi-disciplinary nature, the crossing and infiltration among the different fields have promoted the development of seed physiology itself and other related sciences. (The discovery of phytochrome and its impacts serve as a good example of this.) In view of the fact that seed is fundamental to agricultural production, seed quality directly affects the growth of crops and the benefit gained from production, and long-term preservation of seed germplasm is also closely relevant to the life of future generations of humanity. With the severe and urgent challenge for efficient conservation of biodiversity, it is a natural trend that the study on seed physiology is gaining ever-increasing importance. The research group of seed physiology headed by Prof. G. H. Zheng and based in the Botanical Garden of the Institute of Botany, Chinese Academy of Sciences, has conducted profound and continuous studies for decades with significant achievements in various fields of seed physiology. Break-throughs have been made in some key points of theory and technology with unique features. All these can be readily seen in their publications. I believe this book of seed physiology would be valuable for people working in the same field, and I also expect that it would help stimulate the development of seed science and technology in China.

Beijing
March, 1995

Pei-sung Tang (Professor, Ph. D.)
Honorary Director of the Institute of Botany
Academician of the Chinese Academy of Sciences

前　言

种子生理在植物引种栽培和种质保护工作中的独特作用决定了其成为植物园基因库的一个特色组成部分。中国科学院植物研究所北京植物园的种子生理研究开始于20世纪50年代建园初期。当初，北京植物园奠基者俞德浚院士高度重视种子工作，将其列入植物园建园与科研规划之内，并及早成立种子组，组建种子生理实验室，培养人才，立题开展种子生理实验研究，确定了课题的方向与任务。随后在课题深入与发展过程中，一直得到我国植物生理学奠基者汤佩松院士的关怀与指教。在将近半个世纪历程中，本课题紧密配合植物园种质资源收集保存和引种栽培工作的实际需要，围绕着如何获得和保持优质种子为核心，着重在种子生活力控制和种质保存的原理与方法，种子休眠机理和破除休眠、促进萌发的方法，种子逆境发芽生理，特别是吸胀冷害和渗透调控，种子生活力测定以及种子活力的原理及其应用等领域开展系统研究，进行了大量的工作，发表了160多篇论文，出版了4本专著，其中的不少成果已相继直接或间接转化为生产力，有些论点与见解、技术与方法已被收入高校专业教材之中，对推动我国种子学科的发展起到一定的作用。

种子既是基本生产资料，又是人们赖以生存的生产目的物。近年来，随着现代化农业对种子质量要求的提高，加之当前面临世界范围内保护生物多样性的紧迫性，作为植物种质资源库主体的种子种质保护问题倍受重视，势必要求加快种子技术现代化步伐，种子科技队伍也日益壮大，从事种子生理研究的也越来越多。多年来，我们经常接待不少的来访者、索取资料，也有

不少国外同行来函索取资料。为适应加强学术交流的形势需要，同时也是为了进一步促使我们的研究成果更多转化为生产力，特将本课题上述诸领域积累的大量资料系统整理，汇集成专著出版发行。本书前身曾以“种子生理论文选编”为题少量印制，于1995年秋季北京植物园建园40周年园庆期间内部发行，供有限范围内学术交流之用。迄今时隔6年后，随着工作的进展和形势的发展，有必要重新整理后正式发行。

此书系本课题多年工作的结晶，它凝结了恩师的关怀与教诲、全体合作者的共同辛勤劳动和所内外各方的支持与协助，特此一并致谢！同时也感谢联合国粮农组织/国际植物遗传资源委员会（FAO/IBPGR）和国家自然科学基金委员会给以科研经费的资助，使本课题能顺利完成各项既定计划，达到预期目标。在此，作者还由衷感谢中国科学院出版基金委员会及中国科学院植物研究所所长基金给予出版经费的资助，俾使本书得以如愿出版发行。

郑光华

2002年春于北京香山之麓，

北京植物园种子生理与种质保存实验室

Foreword

Due to its unique role in plant introduction, cultivation and germplasm preservation, seed physiology is a characteristic component of research in botanical gardens that function as gene banks. The study on seed physiology in the Beijing Botanical Garden, Institute of Botany, Chinese Academy of Sciences started at the initial stage of garden development in the 1950's. Work on seeds was considered a priority by Academician Te-tsun Yu, founder of the Garden, who incorporated it in the plan for garden construction and scientific research, which resulted in the prompt establishment of the Seed Research Group and Seed Physiology Laboratory, with the formation of a trained research team, the development of experiment projects on seed physiology and the identification of the aims and tasks of the study. Academician Pei-Sung Tang, founder of phytophysiological research in China, had given persistent attention and advice to the development of seed research programmes. During the course of almost 50 years, the programmes have been serving the practical needs of germplasm collection, preservation and cultivation in the Botanical Garden, centering around the key question of obtaining and maintaining high-quality seed, and focusing on systematic investigations on principles and methods of seed vigour control and germplasm preservation, mechanism of seed dormancy and means of breaking dormancy and promoting germination, physiology of seed germination under adverse conditions, particularly the chilling injury during imbibition and osmotic regulation, test for seed vigour, and principles and application of seed vigour. Four books and over 160 papers in this field have been published. Many research results have helped directly or indirectly the development of productive forces. Some of the formulated theoretical concepts and views, techniques and methods have been included in college textbooks, promothing the advancement of seed researches in China.

Seeds are basic means of production, as well as products people depend on

for living. With the demand by modern agriculture on seeds of higher quality in recent years and the current emergent need for conserving biological diversity world-wide, the issue of preservation of seeds as a major form of plant germplasm resources naturally draws more attention, requiring faster modernzation of seed technology, larger scientific and technical teams working on seeds, and more and more researches on seed physiology. For years, visitors and letters have been coming to us from home and abroad asking for papers and information. To meet the requirement for strengthening academic exchanges and to promote the turning of more of our research achievements into production forces, we have assembled and collated our articles dealing with the relevant topics in the field to produce this book. Its predecessor, with the title of *Selected Works of Seed Physiology*, was issued in the autumn of 1995 on the occasion of the 40th anniversary of the Beijing Botanical Garden with limited number of copies for internal academic exchange and circulation. Six years have passed since then, and further development of the work and the current situation make it necessary to adjust and revise the contents to produce this new edition for open distribution.

This book is a crystal of many years work of our research that embodies the care and advice of our tutors, the diligence of all our co-workers, and the support and assistance we received from within and outside the Institute of Botany of the Chinese Academy of Sciences, to whom we hereby express our gratitude. We are grateful to Food and Agriculture Organization of the United Nations (FAO) /International Plant Genetic Resources Institute (IPGRI) for funding our research programmes, which enabled us to accomplish our work plan and to achieve our aims of study. We also sincerely thank the Publication Foundation Committee of the Chinese Academy of Sciences for financial support towards the publication of this book.

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Spring 2002

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