

STUDIES ON INDUCED MUTATIONS IN HORSEGRAM

[*Macrotyloma uniflorum (Lam.) Verdc*]

———— By ————

Dr. SADASHIV N. BOLBHAT

M.Sc. B.Ed., Ph.D.

Prof. Dr. K. N. DHUMAL

M.Sc., Ph.D.

 **mahi
Publication**

AUTHORS

Dr. SADASHIV N. BOLBHAT M.Sc., B.Ed., Ph.D.

Prof. Dr. K. N. DHUMAL M.Sc., Ph.D.

ISBN:

First Edition: 2020

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, resold, hired out, or otherwise circulated without the publisher's prior written consent in any form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser and without limiting the rights under copyright reserved above, no part of this publication may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying or recording) otherwise without the prior written permission of both the copyright owner and the above-mentioned publisher of this book.

PRICE ₹ 299/-

PUBLISHER MAHI PUBLICATION

-  Office No.1, Krishnasagar Society, Nr. Shivsagar sharda Mandir Road, Ahmedabad-380007
-  mahibookpublication@gmail.com
-  +(91) 798 422 6340
-  www.mahipublication.com

Copyright © 2020\ MAHI PUBLICATION

Dedicated to

The Dreams of my Father
Late Shri. Narayan Y. Bolbhat

DECLARATION

I hereby declare that the work incorporated in this thesis entitled "Studies on induced mutations in horsegram (*Macrotyloma uniflorum* (Lam.) Verdc)" has not been submitted in part or full by me for any degree or diploma of any other university or institute.

Mr. Sadashiv N. Bolbhat
Candidate

Place: Pune

Date:

ACKNOWLEDGEMENTS

It is a great privilege to express my deep sense of gratitude to Prof. K. N. Dhumal, my mentor for his dynamic and able guidance, keen interest and constant encouragement throughout the course of this investigation. His immense insight, ever willing help, unflinching enthusiasm were the great source of inspiration. I must also thank his family members for inspiration and help, who developed such a nice '*Gurukul*'.

I sincerely thank Prof. S.S. Deokule, Head, Department of Botany, University of Pune and former Head Prof. V.R. Gunale, for providing the necessary research facilities.

I gratefully acknowledge the authorities of UGC, New Delhi for granting me Teacher fellowship under FIP (11th plan).

I take this opportunity to express my gratitude to Dr. Nanasaheb Gaikawad, Principal, Rayat Shikshan Sanstha's Dada Patil Mahavidyalaya, Karjat (Ahmednagar) for his guidance, inspiration and constant encouragement.

I am greatly indebted to Dr. Ashok Bhuite and Dr. K.H. Shinde, former Secretary and Joint Secretary, Rayat Shikshan Sanstha, Satara for sanctioning study leave.

I am very grateful to Dr. V.W. Bendale and Dr. Sandip Mahadik, Department of Agril. Botany, College of Agriculture, Dr. B. S. K. K. Agril University, Dapoli (Ratnagiri) for the supply of authentic seed material of horsegram germplasm, help in conducting multilocation trails at their research farm and for useful suggestions during the course of this study.

I place on record my deep sense of gratitude towards the farmers Mr. Nana Pedanekar (Pimpalwadi, Tal-Kankavali), Mr. Vitthal Dhande, Dnyandeo Bobde (Karjat, Dist- A. nagar), as well as the former Agril. Officers Mr. Bhausaheb Bharate and Mr. Rajendra Bansode (Karjat Seed Farm, Patharwadi, Tal-Karjat) for providing field facilities to conduct the research experiments.

Many thanks to my colleagues Mr. B.B. Gawade, HOD, Botany, Dr. S.D. Jadhav, HOD, Chemistry, Dr. Amarnath Jagadale, Vice Principal, Science faculty, Mr. Vikram Bhoge and Mr. Ambadas Suryawanshi for their moral support and encouragement.

I am thankful to Dr. Mrs. Agte (ARI, Pune) for the help in analysis of seed antinutrients and Dr. Pravin Taware for the help in statistical analysis.

Heartfelt gratitude is extended to all my respected teachers and research scholars in mutation breeding for their timely help and encouragement.

My sincere thanks to, Dr. H.S. Patil, Dr. Nivedita Ghayal, Dr. Chanda Hase, Dr. R.R. Vaidya, Dr. Rajendra Kokane, Dr. Digambar Ahire, Dr. Vinayak Lokhande, Ravikiran Pagare, Ram, Ravi, Mahendra, Yogita, Shilpa, Samarpita, Yogesh, Pradeep, Jitendra, Shahnawaz, Shaila, Seema, Pritam, Varsha and Santosh Sutar.

I am highly indebted to my beloved parents, brothers, sisters, close relatives and well wishers for their love, affection and moral support, which is beyond the words. I will be failing in my duties if I do not extend my sincere thanks to my better half Mrs. Sarojini, daughter Pallavi and son Shantanu, without their support it was not possible to complete this small piece of work.

Pune, January, 2010

Sadashiv N. Bolbhat

Contents

Sr. No.	Particulars	Page No.
	List of Tables	
	List of Figures	
	List of Plates	
	Abbreviations	
Chapter-I INTRODUCTION		
1.1.	Scenario of pulses in India and abroad	
1.2.	Production of pulses in India and abroad	
1.3.	Area, production and yield of pulses in Maharashtra	
1.4.	Leading districts in Maharashtra cultivating pulses	
1.5.	Area under cultivation and production of horsegram in Maharashtra	
1.6.	Import and export of pulses	
1.7.	Pulse research centers in India and Maharashtra	
1.8.	Major constraints in pulse production	
1.9.	Future challenges for improving yield of pulses	
1.10.	Horsegram- the minor pulse crop	
1.11.	Need for further research on horsegram	
1.12.	Importance and scope of mutation breeding	
1.13.	New techniques for mutation induction	
1.14.	Mutation breeding in legumes and horsegram	
1.15.	Objectives	
Chapter-II REVIEW OF LITERATURE		
2.1.	Effect of mutagens on seed germination, lethality, seedling injury and pollen sterility	
2.2.	Frequency and spectrum of chlorophyll mutations	
2.3.	Mutagenic effectiveness and efficiency	
2.4.	Viable mutations	
2.5.	Quantitative characters	
2.6.	Dry matter accumulation and harvest index	
2.7.	Root nodules	
2.8.	Physiological, biochemical and enzymological changes	
2.9.	Antioxidants	
2.10.	Antinutrients	
Chapter-III MATERIAL AND METHODS		
3.1.	Seed material	
3.2.	Mutagens used	
3.3.	Treatment details	

3.4.	Experimental site	
3.5.	Soil and climate	
3.6.	Experimental design for field experiments	
3.7.	Observations on M ₁ generation	
3.8.	Quantitative traits (Micromutations)	
3.9.	Observations on M ₂ generation	
3.10.	Chlorophyll mutations	
3.11.	Viable mutations (Macromutations)	
3.12.	Quantitative traits (Micromutations)	
3.13.	Dry biomass, root nodules, harvest index and seed yield/hector	
3.14.	Physiological, biochemical and enzymological characterization	
3.15.	Antioxidants	
3.16.	Observations on M ₃ generation	
3.17.	Characterization of viable mutants	
3.18.	Leaf and seed mineral constituents	
3.19.	Nutritional quality of seeds	
3.20.	Characteristics and inorganic constituents in soil	
3.21.	Observations on M ₄ and M ₅ generations	
3.22.	Statistical analysis	
Chapter-IV RESULTS		
4.1.	Observations on M ₁ generation	
4.2.	Quantitative traits (Micromutations)	
4.3.	Observations on M ₂ generation	
4.3.1.	Chlorophyll mutations	
4.3.2.	Viable mutations (Macromutations)	
4.4.	Quantitative characters (Micromutations) in M ₂ and M ₃ generations	
4.4.1.	Quantitative traits	
4.4.2.	Dry biomass, root nodules, seed and biological yield and harvest index	
4.4.3.	Physiological, biochemical and enzymological characterization (M ₂ and M ₃ generation)	
4.5.	Morphological characterization of M ₃ mutants	
4.6.	Dry biomass, root nodules, seed and biological yield and harvest index of M ₃ mutants	
4.7.	Physiological, biochemical, and enzymological characterization of M ₃ mutants	
4.8.	Mineral constituents in the leaf of viable mutants	
4.9.	Mineral constituents in seeds of viable mutants	
4.10.	Nutritional quality of seeds	
4.11.	Characteristics and inorganic constituents in soil	

Chapter-V DISCUSSION		
5.1.	Observations on M ₁ generation	
5.2.	Quantitative characters (Micromutations)	
5.3.	Observations on M ₂ generation	
5.3.1.	Chlorophyll mutations	
5.3.2.	Viable mutations (Macromutations)	
5.4.	Quantitative Characters (in M ₂ and M ₃ generations)	
5.4.1.	Quantitative traits (Micromutations)	
5.4.2.	Dry biomass, root nodules, seed and biological yield and harvest index (M ₂ and M ₃ generation)	
5.4.3.	Physiological, biochemical and enzymological characterization (M ₂ and M ₃ generation)	
5.5.	Morphological characterization of M ₃ mutants	
5.6.	Mineral constituents in leaf and seeds of viable mutants	
5.7.	Nutritional quality of seeds	
5.8.	Observations in M ₄ and M ₅ generations	
Chapter-VI SUMMARY AND CONCLUSION		
	BIBLIOGRAPHY	
	PUBLICATIONS	