



Interactive Meeting on

Male Sterility Systems in Horticultural Crops- Present Status and Future strategies

Organized by
Society for Promotion of Horticulture
and
Indian Institute of Horticultural Research
Bengaluru

Date: 24th January 2014
Venue: IIHR, Bengaluru



Plant kingdom has many wonders where individual species evolve its own strategy for survival. Some of these naturally evolved survival strategies are further exploited for the benefit of mankind. Pollination control mechanism operating in plants is one such wonderful phenomenon that is efficiently utilised in plant breeding program particularly in the development of hybrids. Reproductive isolation, male sterility, self incompatibility are some of the pollination control mechanisms that plant species have evolved as adoptive mechanisms to ensure cross breeding. Among these mechanisms, male sterility is the most important commercially used phenomenon to develop F_1 hybrids.

Male sterility is a failure of plants to produce functional anthers, pollen or male gametes. Advances in plant science have lead to better understanding and control of male sterile systems in plants. Biotechnological approaches involving molecular markers and genetic engineering have given a new dimension to utilisation of male sterility. Barnase-barstar system is one such development in genetic engineering of male sterility. Recent molecular studies have reported association of male sterility with chimeric mitochondrial open reading frames (ORFs) which are combination of mitochondrial genes with ORFs created in plant mitochondrial genome due to their high recombinogenic activity. The transcripts originating from these chimeras are translated into unique proteins that appear to interfere with mitochondrial function and pollen development. The physiological and in depth molecular aspects by which the products of these chimers interfere with the formation of male gametophytes are still the subject of intense research. Genetic diversification and value addition to stable male sterile lines along with maintainers in high heterotic backgrounds will enhance the potential of male sterility systems for commercial exploitation.

F_1 hybrids in horticultural crops especially in vegetables have made revolution in enhancement of productivity. Male sterility based F_1 hybrids reduce the labour requirement in seed production by 40-70% as the emasculation and pollination by manual methods are not required. Uniform, good quality, highly vigorous, value added and stable male sterile lines increase the yielding ability and quality of F_1 hybrids, ultimately resulting in high productivity. Integration of advanced male sterile technology with hybrid seed production technology will help to bridge the gap between demand and supply of quality seed and in turn to meet the production requirement of country.

Research efforts at IIHR, Bengaluru from past several years resulted in development of male sterile lines in onion, chilli, okra, carrot, cauliflower, ridge gourd and marigold for generating hybrids. Cytoplasmic male sterile (CMS) lines were used in onion to develop F_1 hybrids namely Arka Kirthiman and Arka Lalima. In chilli, the cytoplasmic genic male sterile (CGMS) lines were used to develop F_1 hybrids namely Arka Meghana, Arka Sweta, Arka Harita and Arka Khyati. Furthermore, GMS lines in okra, brown anther and petaloid types (CMS) in carrot, CMS lines in cauliflower and petaloid types (CGMS) in marigold have been developed. Besides, CMS lines in ridge gourd have been identified. Male sterile lines developed in onion, chilli and okra are very popular and commercialized to many private seed industries and public institutions.

Male sterility mediated F_1 hybrids are gaining more popularity and commercial value in horticultural crops particularly in vegetable and ornamental crops. Recognizing the importance of this area, Society for Promotion of Horticulture, Bengaluru in collaboration with IIHR, is organizing one day interactive meeting on **“Male Sterility Systems in Horticultural Crops- Present Status and Future strategies”** on 24th January 2014 at IIHR Bengaluru. This meet is an attempt to create awareness, to deliberate and debate on strategies and prospects of using male sterility in horticultural crop breeding programs and promotion of male sterility based F_1 hybrids to make available the seeds at affordable price to farming community.

Eminent scientists from Public and Private Sectors will be participating as resource persons to share their experiences.



The program shall cover the following theme areas:

- Pollination control mechanisms in crop plants and their utilization in developing hybrids
- Evolutionary significance of male sterility in crop plants
- Mechanisms of male sterility and development of hybrids
- Genetic and inductive approaches in male sterility development
- Molecular and transgenic approaches in understanding and developing male sterile lines
- Status and challenges of utilising male sterility in horticultural crop improvement
- Commercial exploitation of male sterility in ornamental crops
- Challenges in commercial exploitation of male sterility by seed industries

Registration fee

Corporate members	: Rs. 1500/-
General	: Rs. 1000/-
Students/SPH members	: Rs. 500/-

Demand draft/ Cheque drawn in favour of **SPH, Bengaluru** payable at Bengaluru along with filled in Registration form may kindly be sent to the Secretary, Society for Promotion of Horticulture, IIHR, Hessaraghatta Lake PO, Bengaluru-560 089 for registration.

Organizing Committee:

Chief Patron : Dr. N.K. Krishna Kumar, DDG (Horticulture), ICAR, New Delhi.

Chairman : Dr. A.S. Sidhu, Director, IIHR and President, SPH, Bengaluru

Co-Chairmen :

Dr. A.T. Sadashiva, Principal Scientist and Head, Division of Vegetable Crops, IIHR and Vice President, SPH, Bengaluru.

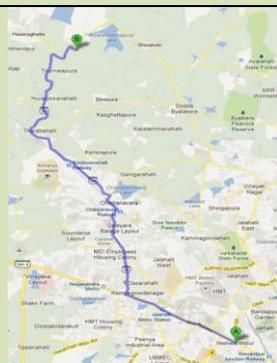
Dr. T.S. Aghora, Principal Scientist, Division of Vegetable Crops, IIHR and General Secretary, SPH, Bengaluru.

Organizing Secretary:

Dr. R. Veere Gowda, Principal Scientist, Division of Vegetable Crops, IIHR, Bengaluru

Conveners:

Dr. M. Prabhakar
Dr. K. Madhavi Reddy
Dr. N. Mohan
Dr. Tejaswini
Dr. M. Pitchaimuthu
Dr. B. Varalakshmi
Dr. E. Srinivasa Rao
Dr. S.S. Hebbar
Dr. Anil Kumar Nair
Dr. Anuradha Sane
Dr. D.C. Lakshmana Reddy



Route map

For further details kindly contact

Organizing secretary: Dr. R. Veere Gowda

Mob/Tel: 09449658825 or 28466420 ext: 281

Email: rvgowda@ihr.ernet.in and gowdadrv@yahoo.com



Registration form

Interactive meeting on Male Sterility Systems in Horticultural Crops- Present Status and Future strategies

Organized by
Society for Promotion of Horticulture
&
Indian Institute of Horticultural Research,
Bengaluru

Date: 24th January, 2014

Venue: IIHR, Bengaluru

Name:

Designation:

Address for communication:

Phone/Mobile:

Email ID:

Category: Student/ SPH member/ General/ Corporate

Mode of Payment: Cash/ DD/ cheque

Signature

Male Sterility Systems in Horticultural Crops- Present Status and Future Strategies

Dr. Veere Gowda. R, Principal scientist and organizing secretary, Division of Vegetable crops, IIHR, Hesaraghatta, Bengaluru

Plant kingdom has many wonders where individual species evolve their own strategy for survival. Some of these naturally evolved survival strategies are further exploited for the benefit of mankind. Pollination control mechanism operating in plants is one such wonderful phenomenon that is efficiently utilized in plant breeding program particularly in the development of hybrids. Reproductive isolation, male sterility, self incompatibility and gynoecey are some of the pollination control mechanisms that plant species have evolved as adaptive mechanisms to ensure cross breeding. Among these mechanisms, male sterility is the most important commercially used phenomenon to develop F_1 hybrids.

Male sterility mediated F_1 hybrids are gaining more popularity and commercial value in horticultural crops particularly in vegetable and ornamental crops. Recognizing the importance of this area, Society for Promotion of Horticulture, Bengaluru in collaboration with Indian Institute of Horticultural Research (IIHR), organized an interactive meeting on “Male Sterility Systems in Horticultural Crops- Present Status and Future strategies” on 24th January 2014 at IIHR, Bengaluru.

Eminent scientists from public and private sector are participated as resource persons to share their experiences. There were nine lead lectures delivered on theme areas covered in the programme namely Pollination control mechanisms in crop plants and their utilization in developing hybrids, evolutionary significance of male sterility in crop plants, mechanisms of male sterility and development of hybrids, genetic and inductive approaches in male sterility development, molecular and transgenic approaches in understanding and developing male sterile Lines, status and challenges of utilizing male sterility in horticultural crop improvement, challenges in commercial exploitation of male sterility by seed industries, induction of male sterility in okra and its utilization in commercial seed production and commercial exploitation of male sterility in ornamental crops followed by open discussion. At the end of meeting deliberation on initiation of joint ventures with private seed industries and public Institutes were held. Two hundred delegates from National Agricultural Research System (NARS), ICAR Research Institutes and private seed industries have actively participated in the deliberations of the meeting.

Inaugurating the meeting Dr. Amrik Singh Sidhu, President, Society for promotion of horticulture (SPH) and Director, (IIHR), Hesaraghatta, Bangalore stressed the need to develop male sterility mediated F_1 hybrids to reduce the cost of F_1 hybrids. Cultivation of F_1 hybrids is expensive due to high cost of F_1 hybrid seeds especially in vegetables and marigold. The F_1 hybrid seeds need to be made available at affordable price to the farmer. Dr.N.K. Krishna Kumar, Deputy Director general (DDG), Horticulture, Indian Council of Agricultural Research (ICAR), New Delhi in his message to the meet, stressed that there is need to discuss on the basic,

strategic and applied aspects of male sterility especially its stability across environments and regions; its utilization in F₁ hybrid development and seed production with reduced cost. Ultimately all the information needs to be crystallized to develop a project on joint ventures (JVs) with private seed industries. Male sterility mediated F₁ hybrids will have great potential to contribute to the enhancement of horticulture productivity in the country.

Some of the future research areas that emerged out during the presentation and discussion are i) diversification of sterile cytoplasm ii) stability of male sterility across environments iii) finding out reliable molecular markers especially for GMS systems iv) need to integrate desired traits into male sterile systems. Researcher attention to test the possible hypothesized reasons for evolution of male sterility i) out breeding advantage ii) optimum resource allocation iii) and sexual selection to select the best. Understanding evolutionary basis will help us to shape our breeding protocols to derive male sterile (MS) lines. Research areas emerged out during discussion on sexuality in plants and application of male sterility were i) understanding microsporogenesis and male gametophyte development ii) understanding the anatomical reasons for expression of male sterility such as non differentiation of microsporangium in anther, hypo and hyperactive tapetum, malfunctioning of endothecium, or distorted pollen. Some of the future research areas emerged out of the presentations of Genetic and induced male sterility in plants are : i) identification of dose and type of chemicals to induce male sterility, chemical hybridizing agent, understanding the basic of chemical hybridization agents and mode of action ii) study on plant growth regulatory and substances that can disrupt floral development iii) identification and understanding of metabolic inhibitors iv) intensifying efforts on TGMS and PGMS wherever possible.

Among the research areas that emerged out during the presentation of transgenic approaches in development of male sterility and fertility restoration system; the focus was on genetic engineering as precise tool to introduce male sterile traits into plants needs i) to understand requirements for transgenic male sterility ii) different strategies to be tested with special reference to horticultural crops iii) introducing degradative enzymes to produce male sterile plants iv) inhibition of particular enzymes by antisense strategy v) expression of hormone encoding genes, vi) targeting mitochondrial genes to express the male sterility-associated mitochondrial DNA from well-characterized CMS systems vii) approaches through expression of transcription factors and anther specific receptors viii) achieving restoration by selectively blocking the expression of the gene causing male sterility. In summary the research need to be focused on genes, promoters, mitochondrial target sequences, transformation protocols as well as maintenance of male sterility and restoration of male fertility.

Induction of male sterility in okra and its commercial seed production, focus was on the procedure for development of a GMS line and need to develop in different desirable backgrounds using gamma ray mutagenesis. Challenges in commercial exploitation of male sterility in seed industries, future focus required on the development of male sterility in disease resistant backgrounds and high seed yielding female lines and major challenges are increased seed production costs due to higher labour wages, non-availability of skilled labour, frequent

monitoring and IP issues. In commercial exploitation of male sterility in ornamental crops focus needs to be on use of homeotic models in developing male sterility. Status and challenges of use of male sterility in horticultural crop improvement, the future challenges are development of stable male sterility with value addition like incorporation of biotic and abiotic stress, nutritional, nutraceutical and quality.

In a session on Joint Ventures (JV) in the interactive meeting, specific recommendations emerged out of the deliberations namely (i) An urgent need is being felt by the public sector R&D institutions and the Private sector for evolving effective modalities for collaborative research for addressing the emerging issues that impede 'productivity enhancement' in horticultural production systems, while a number of models are already in practice elsewhere, the crop specific modalities need to be worked out in horticultural crops. Though Joint Ventures are welcome, the proposals should aim towards development of specific 'value added products' and care should be exercised in the process of valuation and clear Intellectual property rights policy needs to be specified while formulation stage itself or scope for such clauses to be included in the MTA and MOUs.

This meet helped to create awareness, deliberate and debate on strategies and prospects of using male sterility in horticultural crop breeding programs and promotion of male sterility based F₁ hybrids to make available the seeds at affordable price to farming community.