

SCIENCE SETU WEBINARS by NIPGR

STRESS INTERACTION AND COMBINED STRESSES IN PLANTS: PHYSIOLOGICAL AND MOLECULAR UNDERSTANDING

Press Note

Date: 23rd APRIL, 2021, Friday

Resource person: Dr. Senthil K. Muthappa, Scientist V, NIPGR

The Department of Biotechnology, Government of India, had planned “Science Setu Webinar” as a virtual platform to connect the Research Institutes with postgraduate and graduate students. Under this, our college has been assigned to National Institute of Plant Genome Research (NIPGR), New Delhi. NIPGR is an autonomous institution aided by the Department of Biotechnology. Research at NIPGR focusing on functional, structural, evolutionary and applied genomics of plants, including crop plants. Through this fourth webinar program, our students and faculty members virtually gained an amazing opportunity to connect with NIPGR, New Delhi and anticipated the effects of combined stresses of environmental factors on plant life. It was a spectacular opportunity for students at undergraduate and postgraduate level of science background on exposure to plant-based research on much higher level.

Dr. Amarjeet Singh, Scientist, NIPGR gracefully introduced the resource person with his warm words. The resource person, **Dr. Senthil K. Muthappa**, Scientist V, NIPGR, opened his lecture with the nature of plants being sessile. Plants being permanently restricted to their site of germination had to deal with various environmental factors and that too in combination. To compensate for their lack of mobility, plants evolved unique mechanisms enabling them to rapidly react to ever changing environmental conditions and flexibly adapt, in context to the notion, ‘survival of the fittest’. He also emphasized on the concept of how domestication of wild varieties and monoculture have helped in catering the need of increasing human population. He explained the effects of single stress, sequential stress, multiple single stress and combined stress on plants. He inventively introduced the basis of his lecture, dry root rot disease commonly occurring in rabi season crop chickpea on physiological and molecular level. Chickpea being a protein source contribute to 82% of the global production. Dry root rot is more dominant when the crop is exposed to drought conditions, resulting in the plant completely dried off and ultimately dies. On anatomical level, his team studied the steps involved in the formation of infection thread on attack of

Rhizoctonia bataticola, causal organism of the disease. They also noted the level of water potential in the concerning crop in control and drought conditions on physiological level. He later discussed the hormonal aspect related to combination of stress, in terms of abiotic (ABA) and biotic (Jasmonic acid and Salicylic acid) stress conditions. He concluded his lecture by discussing the various management practices to counter the effects of the pathogen attack during drought conditions. At the end of his lecture, he acknowledged his team and their publications in relation to the dry root rot disease. In total 53 participants, including faculty of science and students attended the event. Dr. Pinky Agarwal, Scientist, NIPGR attended the questions of the participants and gave vote of thanks. It was a quite exciting and brainstorming experience for everyone.



Science Sets Webinars by NIPGR

Fourth webinar
on **23rd April, 2021, Friday**
at **3:00 pm.**

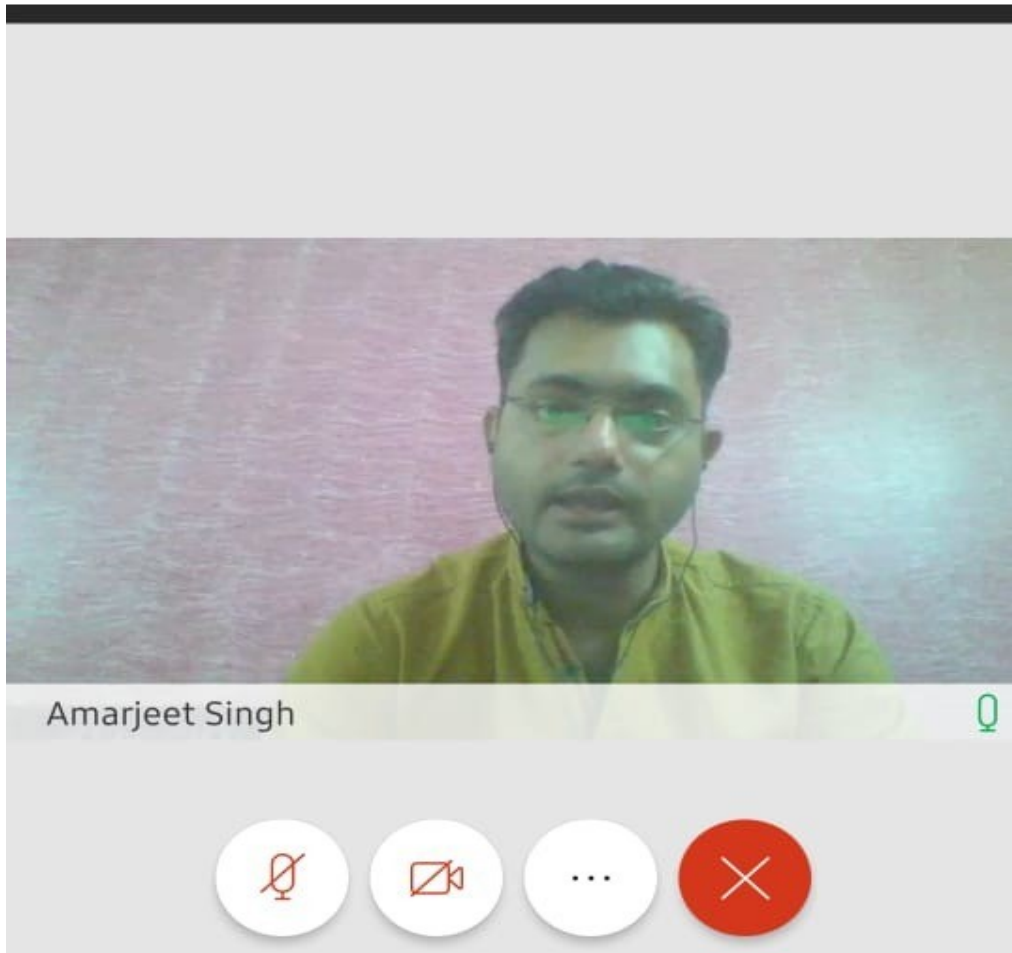
**"Stress interaction & combined stresses in plants:
physiological & molecular understanding"**

by
Dr. Senthil K. Muthappa
Scientist V, NIPGR

Moderated by
Dr. Pinky Agarwal & Dr. Amarjeet Singh
Scientists, NIPGR

Link for the webinar:
<https://www.webex.com/webex/secure/join/157136654633011270>
833024751424242424

Please join 15 minutes before the start of seminar to resolve technical glitches if any.





Webex



Stress interaction & combined stresses in plants

Muthappa Senthil-Kumar
Scientist

National Institute of Plant Genome Research, New Delhi
skmuthappa@nipgr.ac.in

Science Setu Webinars by NIPGR
Fourth webinar

23.04.2021



Amarjeet Singh




Webex

Stress interaction & combined stresses in plants

Muthappa Senthil-Kumar
Scientist
National Institute of Plant Genome Research, New Delhi
skmuthappa@nipgr.ac.in

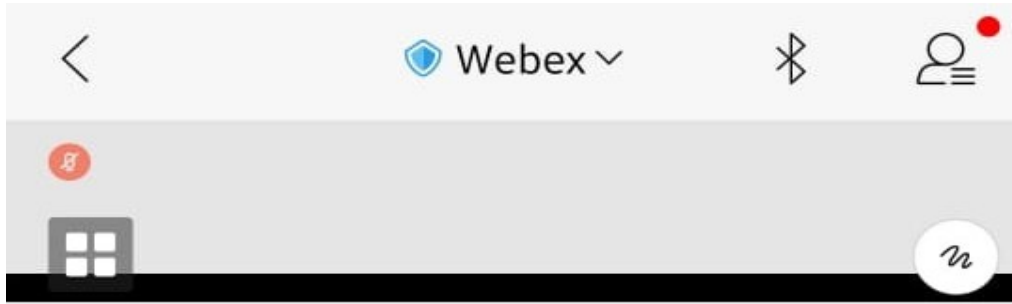
Science Setu Webinars by NIPGR
Fourth webinar
23.04.2021



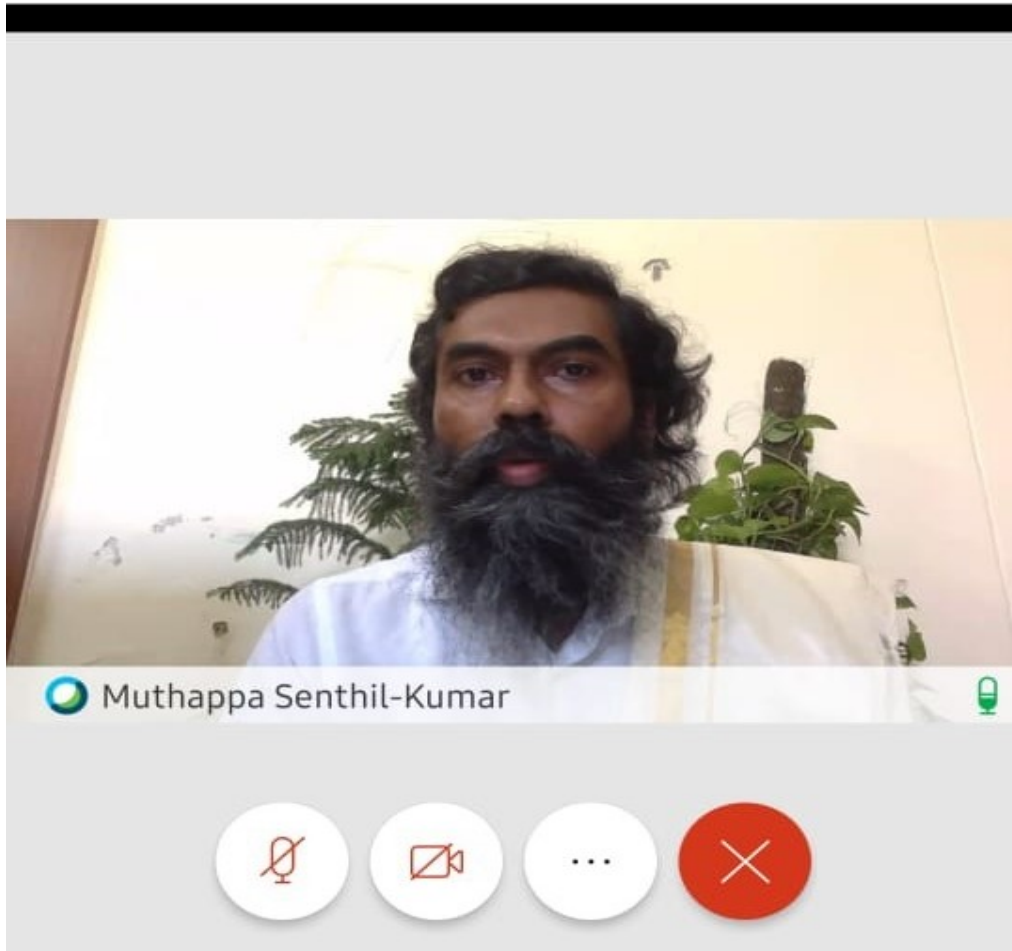
Muthappa Senthil-Kumar

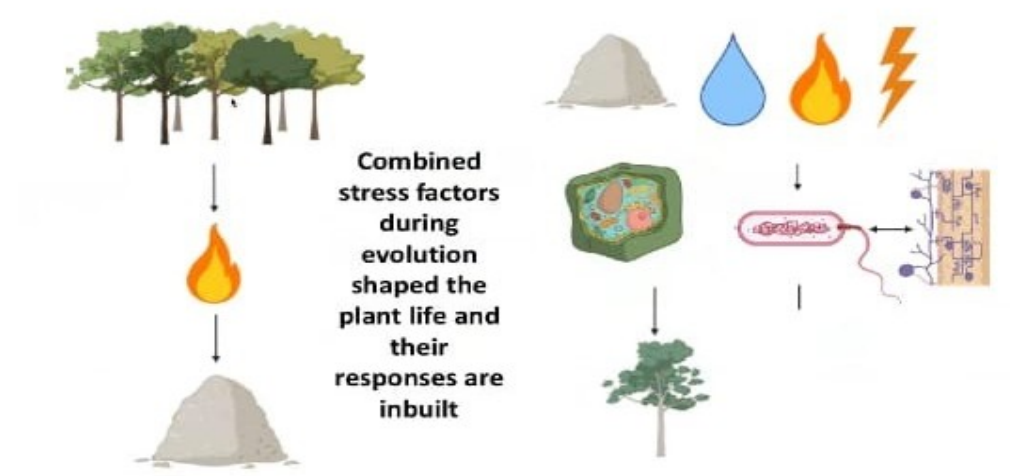
Speaking: Muthappa Senthil-Kumar, Pinky ...

Webex interface controls: mute, video, menu, and end call.



Plants and environmental factors (stresses)

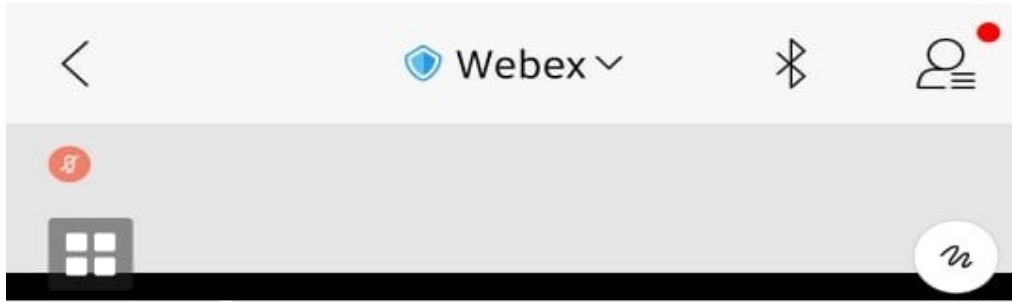




Muthappa Senthil-Kumar

Speaking: Muthappa Senthil-Kumar

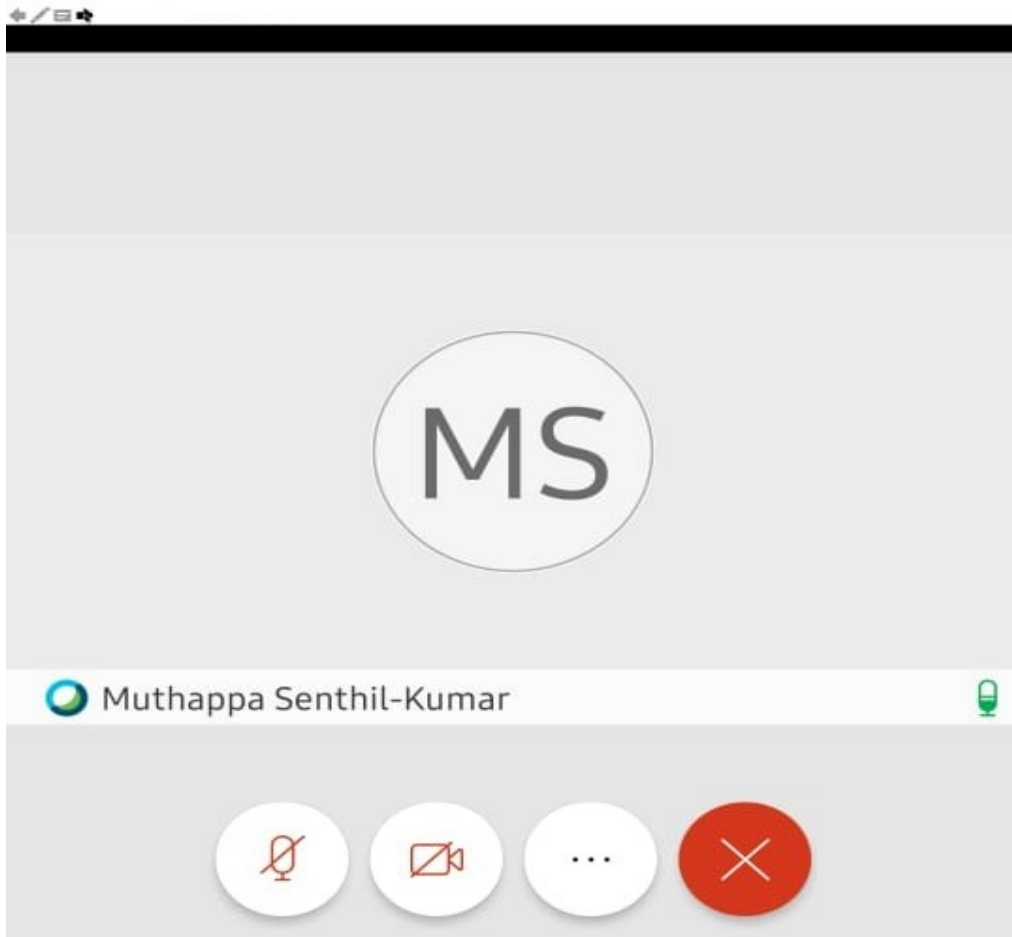
Control panel with icons for mute, video, more options, and close.



Domestication and monoculture to cater the needs of human population



Plant responses to the stresses are different and are focus of the researchers





Webex



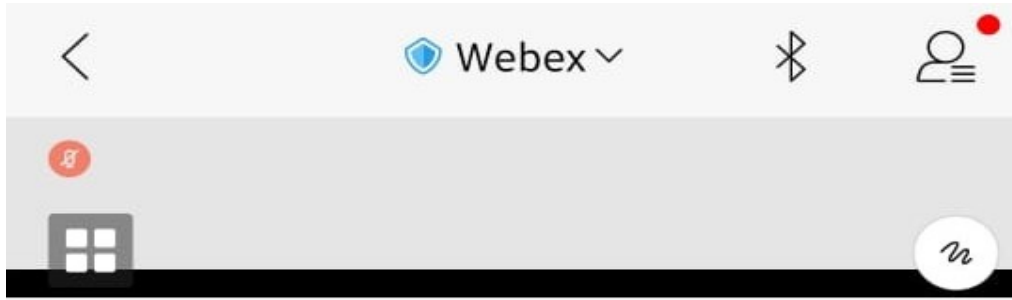
This necessitated yield protection under combined stresses by producing superior plant types



MS

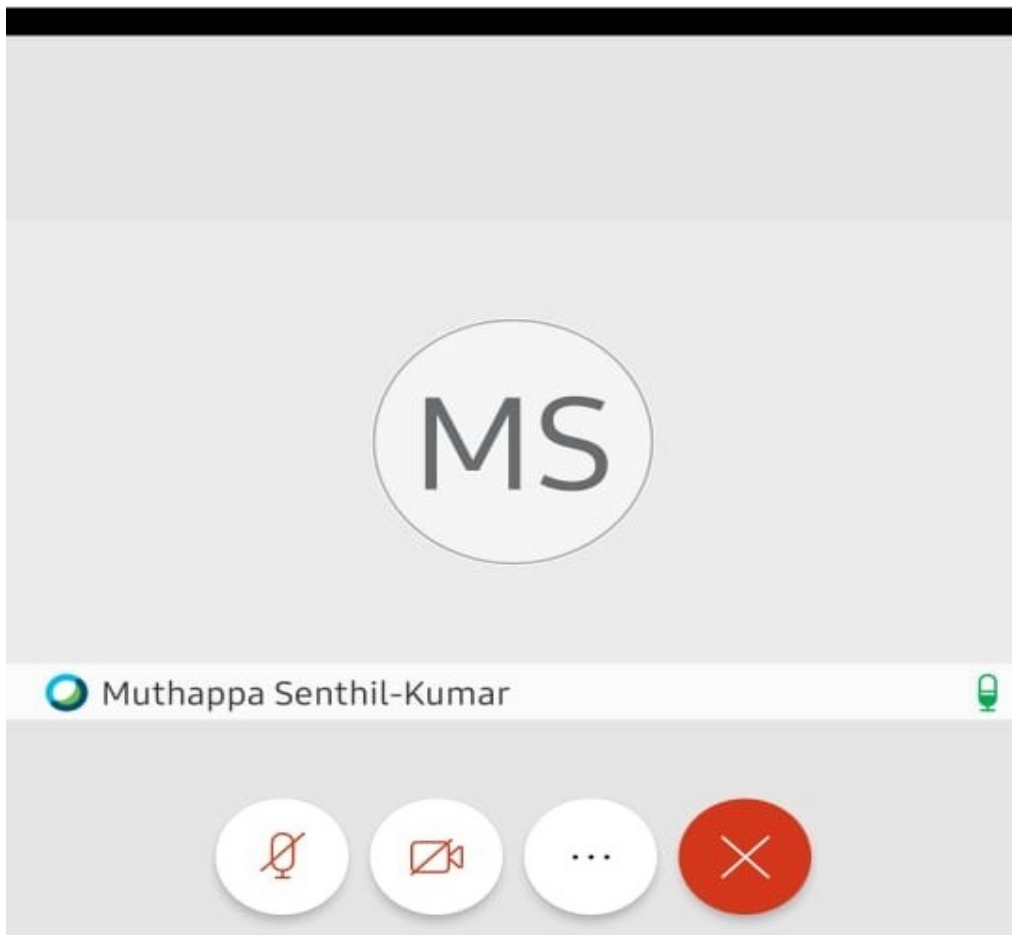
Muthappa Senthil-Kumar

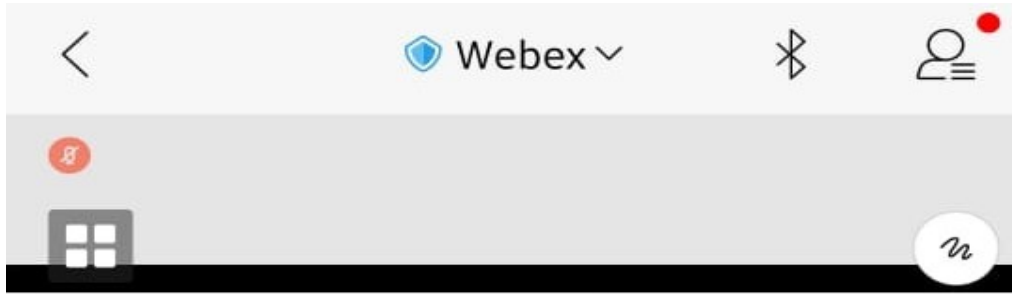




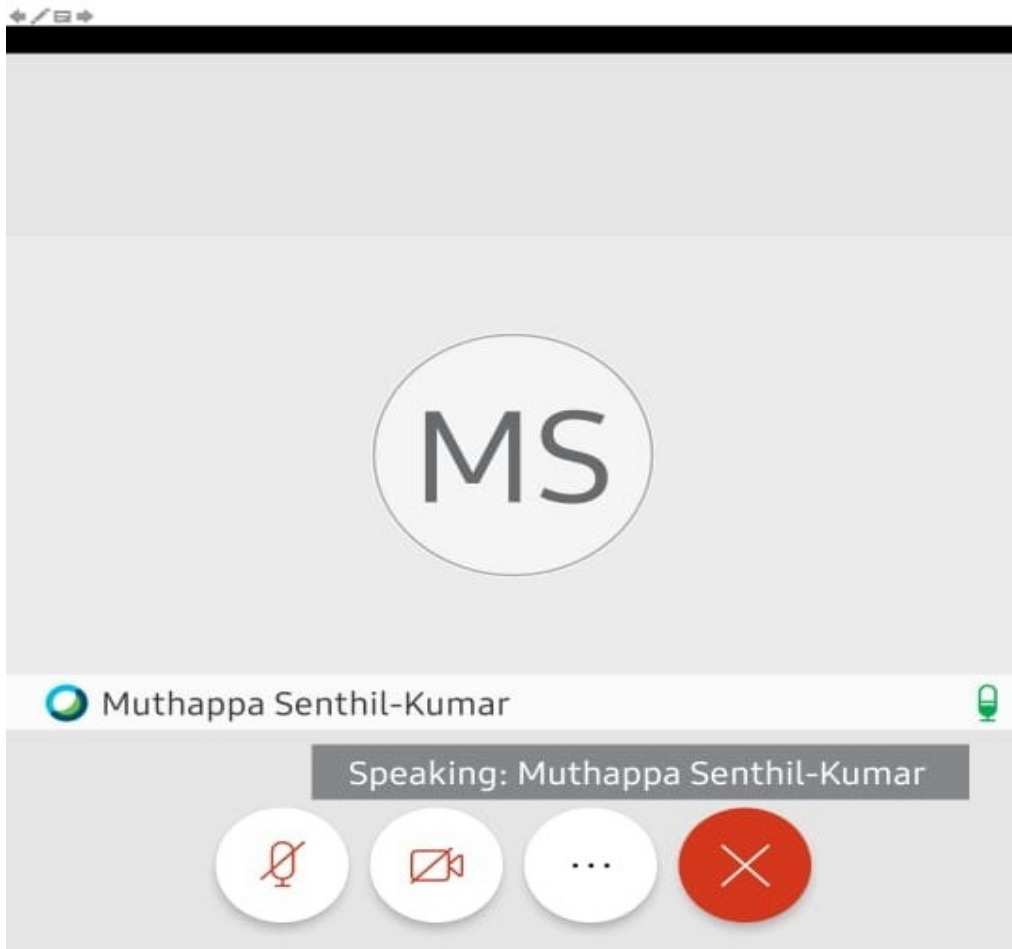
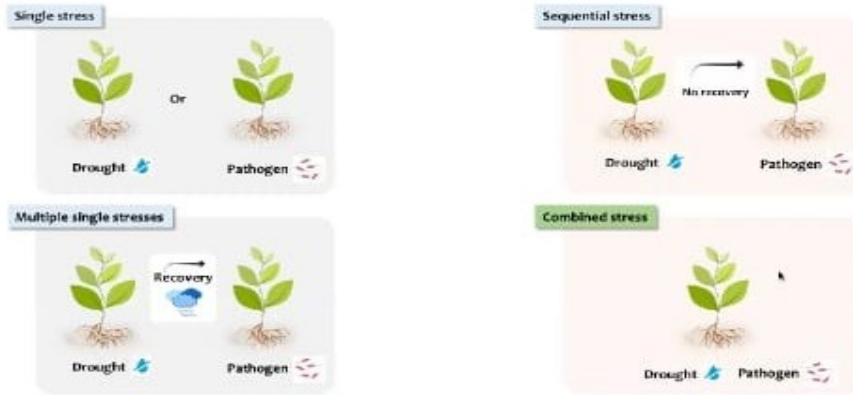
Abiotic stresses influence plant-pathogen interaction

Drought and pathogen combined stress





Coming to terms with combined stress



Navigation bar with a back arrow, Webex logo, Bluetooth icon, and a profile icon with a red notification dot. Below this is a secondary bar with a red mute icon, a window grid icon, and a circular profile icon with a handwritten signature.

Plant health in CHANGING CLIMATE

Plant diseases are among the biggest threats to food security and quality



The changing climate impacts plant health, making our crops more susceptible to diseases

Changes in environment affects the reproduction and distribution of pathogens, influencing the occurrence of plant diseases



A large, light gray rectangular area containing a large, dark gray circle with the letters 'MS' inside, representing the initials of the speaker.

Muthappa Senthil-Kumar



A bottom control bar with four circular buttons: a red mute button, a red video off button, a white menu button with three dots, and a red end call button with an 'X'.



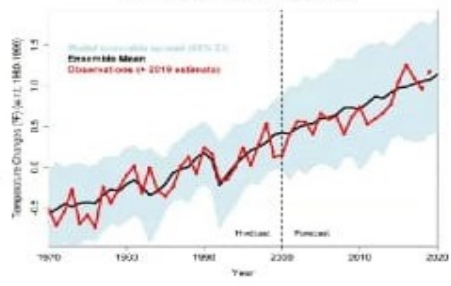
Longer Summer, Stretches of Drought, Extreme Heat and Flooding Expected in a Warming World



Water Stress by Country: 2040



Forecast evaluation for models run in 2004



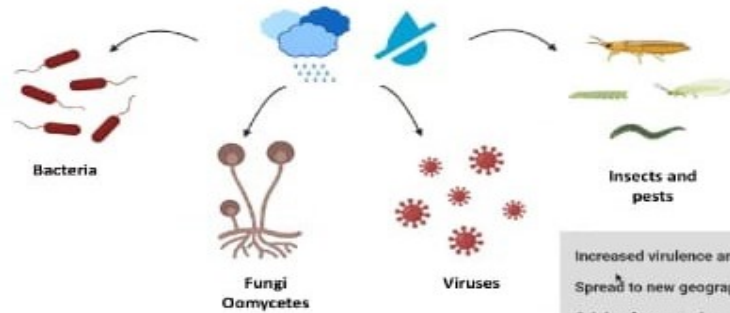
MS

Muthappa Senthil-Kumar





Precipitation extremes → Heavy rainfall or drought episodes

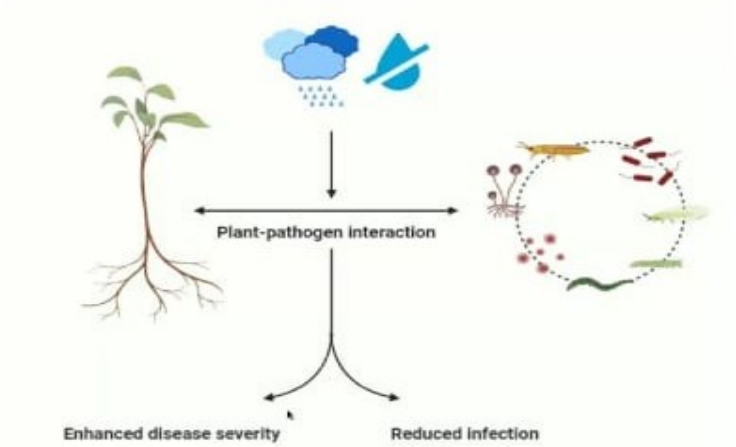


- Increased virulence and aggressiveness
- Spread to new geographic ranges
- Origin of new strains
- Changes in behaviour of vector
- Increased epidemic risks



MS



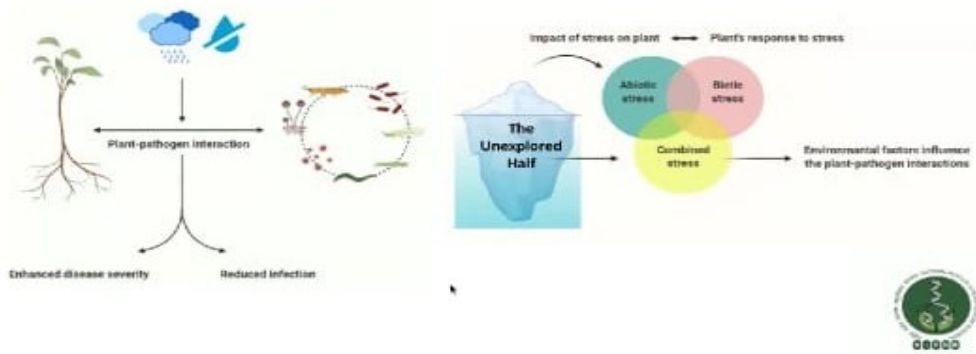


MS

Muthappa Senthil-Kumar



Focus is needed to study the stress interaction, their combined impact on plants and how plants respond to this new state of stress



MS

Muthappa Senthil-Kumar



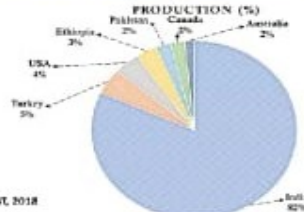


MS

Muthappa Senthil-Kumar



Chickpea, important protein source for India's population



	Per 100 grams
Protein	19 g
Sugar	11 g
Total Fat	0 g
Saturated fat	0.0 g
Polysaturated fat	2.7 g
Monounsaturated fat	1.5 g
Cholesterol	0 g
Sodium	24 mg
Potassium	875 mg
Total Carbohydrate	61 g
Dietary fiber	17 g



FAOSTAT, 2018

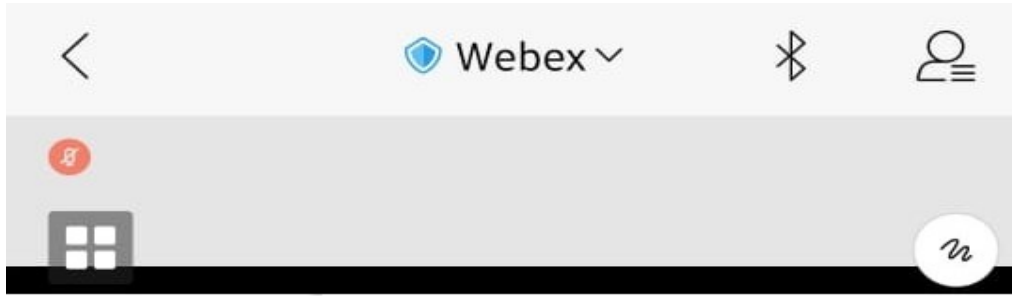
USDA



MS

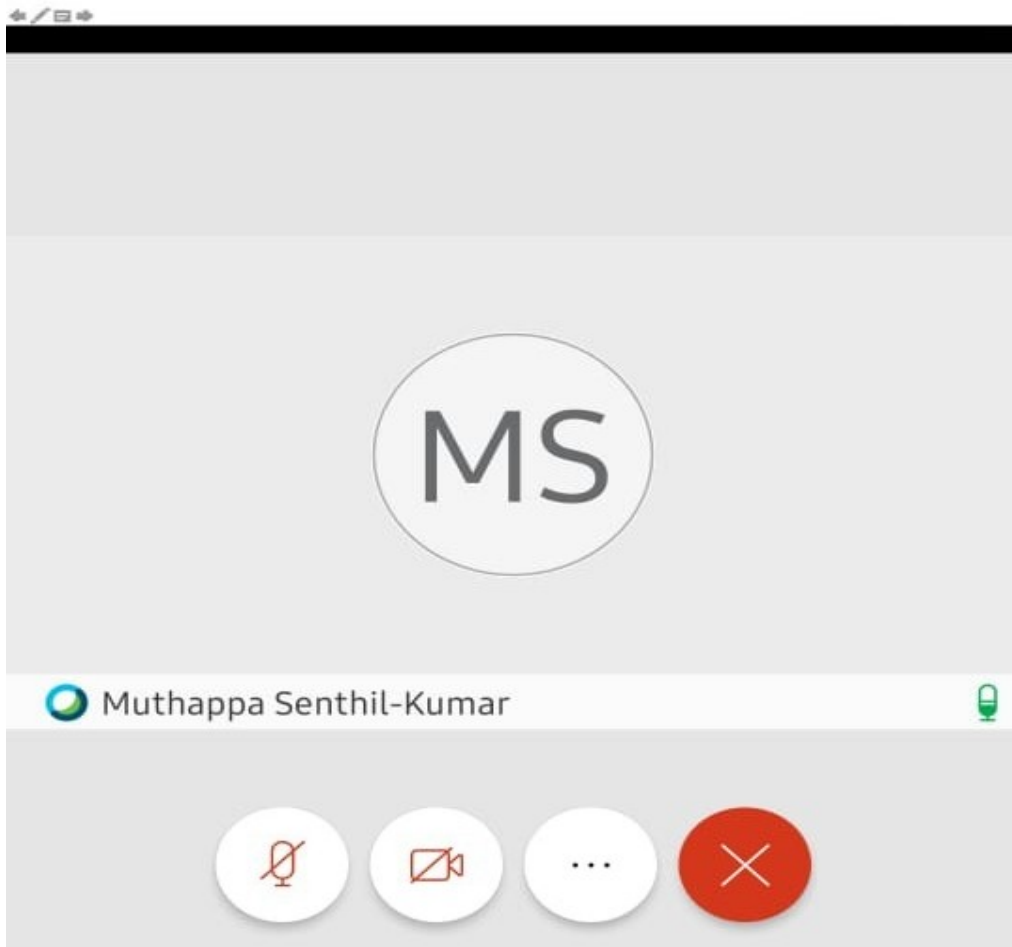
Muthappa Senthil-Kumar

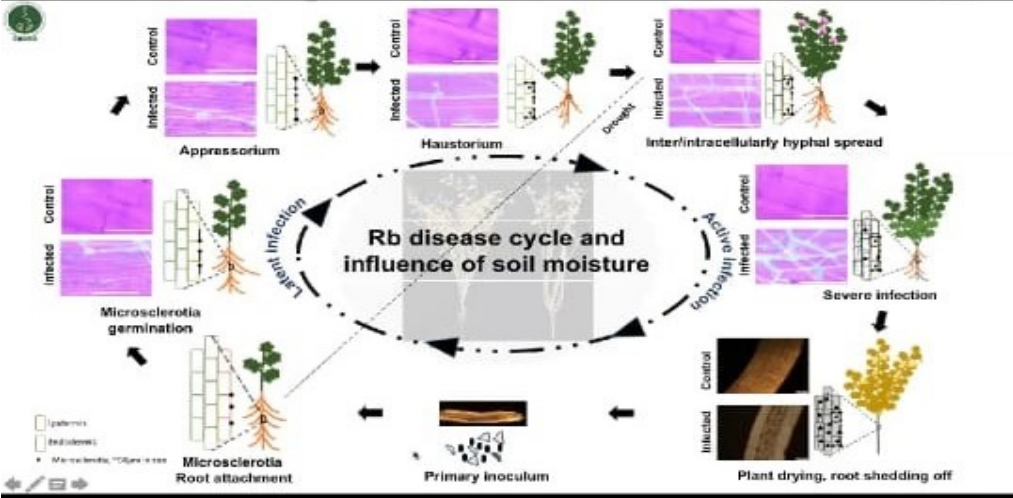




***Rhizoctonia bataticola*, the causal agent of dry root rot disease**

- Kingdom - Fungi
- Division - Basidiomycota
- Subdivision - Agaricomycotina
- Class - Agaricomycetes
- Order - Cantharellales
- Family - Ceratobasidiaceae
- Genus - *Rhizoctonia*
- Species - *bataticola*





MS



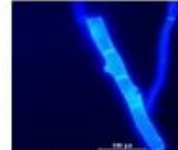


Dry root rot and *Rhizoctonia bataticola*

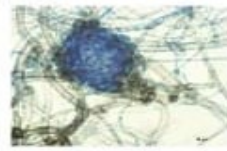
Typical symptoms in the field



R. bataticola
Morphology



R. bataticola
Septate hyphae



R. bataticola
Microsclerotia



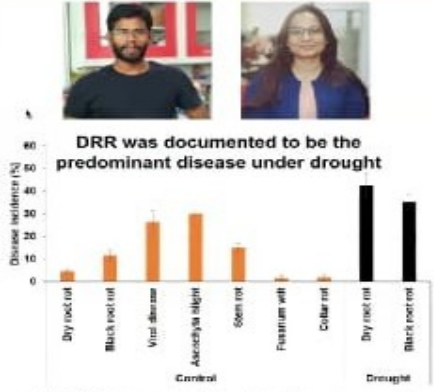
MS

Muthappa Senthil-Kumar



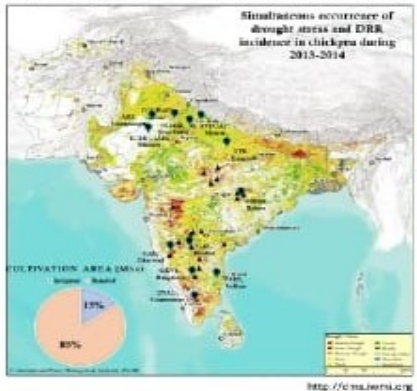


Dry root rot: chickpea disease occurrence in India



• Rainfed crop encounters more disease
 • DRR coupled with drought compromises the yield

Map showing DRR incidence and field trial locations



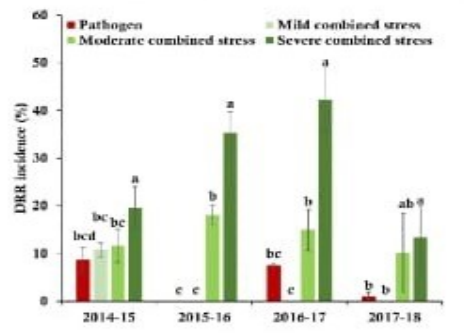
MS

Muthappa Senthil-Kumar

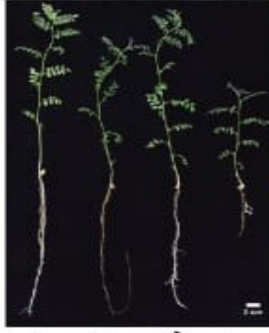




Drought intensifies the DRR disease incidence



Drought aggravates the DRR with increasing drought levels



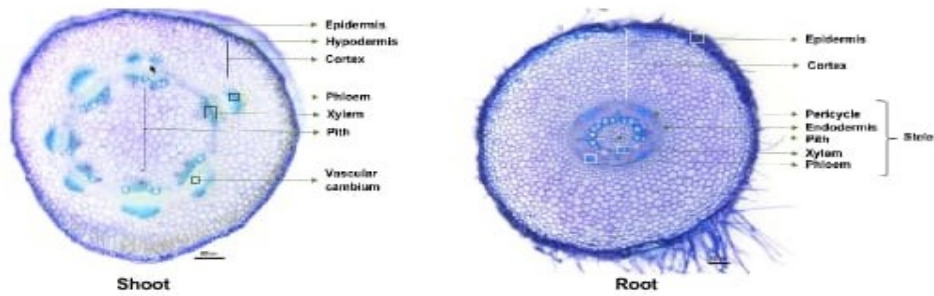
Control
Drought stress alone
Pathogen infection alone
Drought and pathogen



MS



Chickpea root anatomy

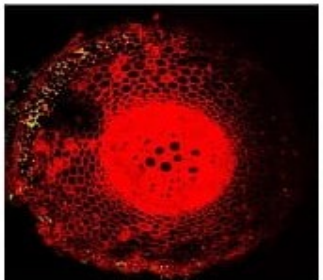


MS

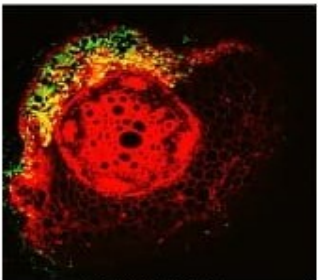
Muthappa Senthil-Kumar



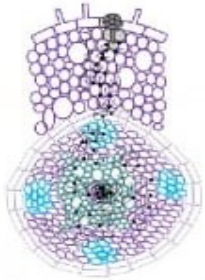
Drought accelerates the fungal colonisation in the root



Pathogen infection under well-watered



Pathogen infection under drought stress



Root anatomy showing the stages of fungal colonisation

Propidium iodide (Red), WGA-FITC (Green); Confocal microscopy



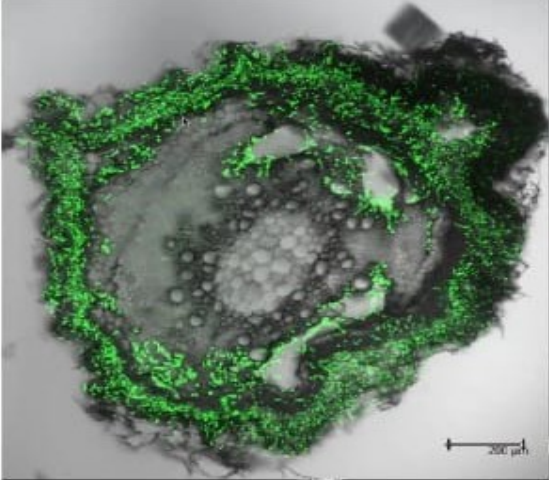
MS

Muthappa Senthil-Kumar



Webex

20



MS

Muthappa Senthil-Kumar

Microphone icon

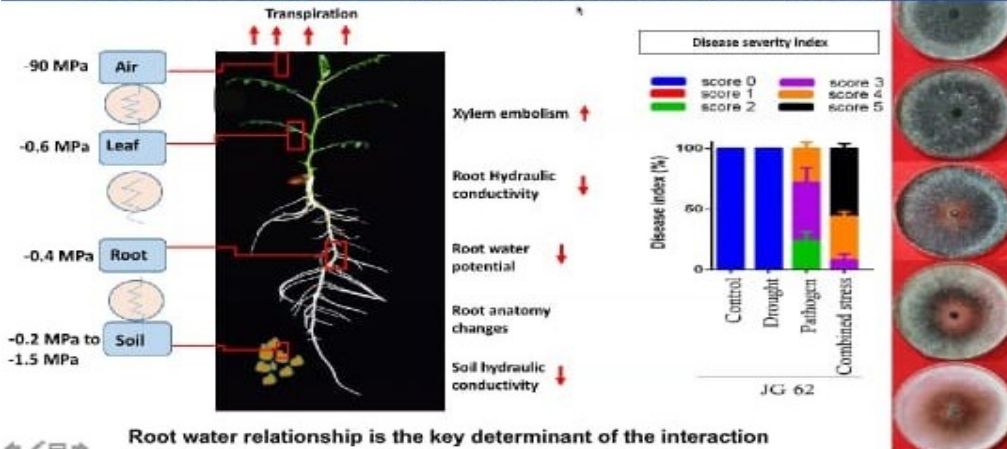
Video icon

More options icon

Close icon



Root water relation is the important determinant of disease outcome

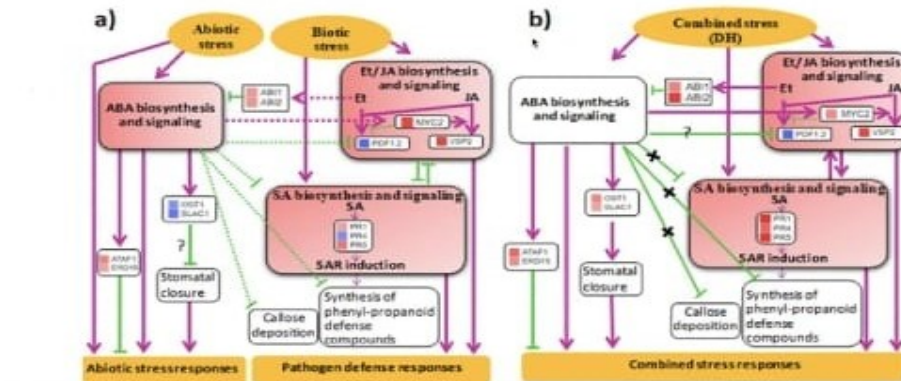


Root water relationship is the key determinant of the interaction





Hormonal network under individual drought and host pathogen and their combination



MS





Disease Management

Irrigation management

Cultivation of non-host crops

To produce resistant crop



Muthappa Senthil-Kumar

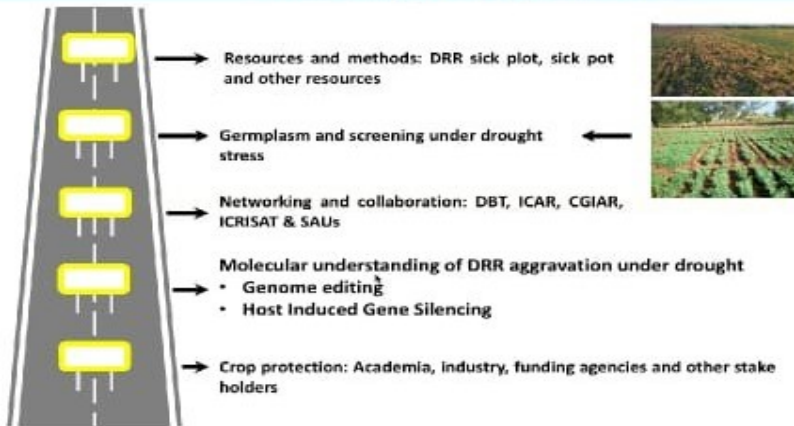


Speaking: Muthappa Senthil-Kumar





Road map to crop protection



MS

Muthappa Senthil-Kumar





Webex



Shruti has joined the audio conference.



Acknowledgment



Muthappa Senthil-Kumar





Combined stress publications from the lab, NIPGR

Shared and unique responses of plants to multiple individual stresses and stress combinations: physiological and molecular mechanisms

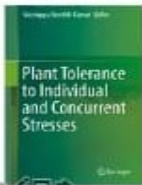
Global Transcriptional Analysis Reveals Unique and Shared Responses in *Arabidopsis thaliana* Exposed to Combined Drought and Pathogen Stress

Plant Stress Responses to Combined Drought and Pathogen Stress

Drought Stress Predominantly Endures *Arabidopsis thaliana* (*Pseudomonas syringae* Infection)

Combined Drought Stress and Bacterial Pathogen Infection Induce Common and Distinct Transcriptional Responses in *Arabidopsis*

Impact of Combined Abiotic and Biotic Stresses on Plant Growth and Response for Crop Improvement by Exploiting Physio-morphological Traits



Global effects of abiotic stresses during combined drought and pathogen stress in *Arabidopsis thaliana* reveal shared and distinct transcriptional responses

Transcriptional changes in *Arabidopsis thaliana* infected with *Pseudomonas syringae* during drought stress

Impact of abiotic stress on combined drought and pathogen stress in *Arabidopsis thaliana*

Understanding the Impact of Drought on Plant and Stress Tolerance in *Arabidopsis thaliana*

Plant Stress Responses to Combined Drought and Pathogen Stress





Webex



MS

Muthappa Senthil-Kumar



Pinky Agarwal

ND

NIPGR New D... (host)



Amarjeet Singh





Chat with everyone

Shivani Thakur

SK

Sandeep Kaur kmv 3:18 pm

Good afternoon to all

Sandeep Kaur

Kanya Mahavidyala, Jalandhar

3:19 pm

Dr. Tejinder Preet

KMV JALANDHAR

SV

Shikha Vashist 3:25 pm

Good Afternoon to all..

SV

Shikha Vashist 3:26 pm

Shikha vashist, KMV, Jalandhar

S

shivani 3:30 pm

shivani thakur [207016](#), kmv
jalandhar

KT

kritika thakur 3:32 pm

kritika thakur [207013](#) bsc medical
KMV college Jalandhar

SS

shakshi singh 3:35 pm

Meerut Collegeg Meerut

Enter message here.





Chat with all panelists

SK

Sandeep Kaur
Bsc (NM)sem 4
Kanya Mahavidyala, Jalandhar

MT

Muskan Thakur 3:30 pm

Muskan Thakur
Bsc Medical sem 6
Kanya Maha Vidyalya
[207140](#)

SK

simranjit Kaur 3:31 pm

simranjit Kaur [207022](#) bsced sem4
kmv

bsc med

S

shivani 3:32 pm

shivani thakur [207016](#) Bsc(medical)
sem 4 , kmv jalandhar

S

samiksha 3:33 pm

Samiksha
[b.sc.](#) med sem 4
Kanya Mahavidyalaya Jalandhar

DC

Diksha Chauhan 3:33 pm

Diksha Chauhan

Enter message here.





Chat with all panelists

DC

Diksha Chauhan 3:33 pm

Diksha Chauhan
MSc Botany 4th sem
kmv college jalandhar

AG

Akrit Kaur Gill 3:34 pm

Akrit Kaur Gill
KMV Jalandhar

A

Akanksha 3:35 pm

Akanksha Msc botany KMV college
jalandhar

R

ruchika 3:36 pm

ruchika
bsc medical
[207029](#)
kmv college

AD

Anshika Dubey 3:39 pm

anshika, [206915](#), bsc medical, kanya
mahavidyalay, jalandhar

S

shivani 3:40 pm

shivani thakur [207016](#)
Bsc(medical)sem 4 ,kmv jalandhar

Enter message here.





Chat with all panelists

S

shivani

3:40 pm

shivani thakur [207016](#)
Bsc(medical)sem 4 ,kmv jalandhar

P

Payal 3:41 pm

Payal
Bsc medical sem 4
[207032](#)

YR

Yogita Rana 3:43 pm

yogita rana msc botany 4 sem Kmv
clg jlnr

NS

neha sharma 3:43 pm

neha sharma
[207007](#)
bsc med sem 4
kmv College jalandhar

MR

Meghna Rana 3:44 pm

bsc medical sem V [207141](#)

P

Payal 3:44 pm

Payal
Bsc medical sem 4
[207032](#)
KMV college Jalandhar

Enter message here.





Chat with all panelists

Payal

Bsc medical sem 4

[207032](#)

KMV college Jalandhar

MR

Meghna Rana 3:47 pm

Bsc medical sem 6th [207141](#)

V

vaani 3:48 pm

Sir what is the scope of
biotechnology in future

SK

Shruti Kalia 3:49 pm

sir, can the human interference with
the help of the present technologies
help in the quality and speed of
evolution of plants against the biotic
and abiotic factors?

V

vaani 3:49 pm

Ok sir

NB

Narendra Burman 3:50 pm

NARENDRA BURMAN

Is there any difference between
micro biota of resistant and
susceptible variety

Enter message here.





Chat with everyone

Kanya Mahavidyalaya

S

samiksha 3:49 pm

Samiksha
bsc med sem4
Kanya Mahavidyalaya Jalandhar

RS

Rajat Singh 3:49 pm

Sir I want know about the Importance of organic farming as now a days lots of chemicals and fertilizers are being used in crop productions, Is there production of crops of high yielding plants possible at a very large scale...

NB

Narendra Burman 3:51 pm

meerut college meerut

NB

Narendra Burman 3:53 pm

Is there any difference between micro biota of resistant and susceptible variety.
Narendra Burman
meerut collage meerut

RS

Rajat Singh 3:53 pm

Ok Sir Thank you so much...Sir...

Enter message here.





Chat with everyone

There is a lot of resistance and

susceptible variety.

Narendra Burman

meerut collage meerut

RS

Rajat Singh 3:53 pm

Ok Sir Thank you so much...Sir...

NB

Narendra Burman 3:55 pm

ok sir thanks you so much sir

NB

Narendra Burman 3:58 pm

Like in animals, we don't have much control for viruses, what's the scenario in plant viral diseases

NB

Narendra Burman 4:02 pm

Ok Sir Thank you so much...Sir...

RS

Rajat Singh 4:02 pm

Sir I want to ask Now a days, There is a dominance of Artificial Intelligence and Technology and Agriculture and Floriculture is considered to be so traditional. Is Agriculture a good future option for the students having Interest in Flora World...

Enter message here.





Chat with all panelists

TS

Tanu sharma 3:52 pm

Tanu sharma bsc biotechnology sem
[4 206651](#)
Kanya Maha vidyalaya Jalandhar

K

karishma 3:54 pm

good noon sir,
Does the occurrence of one disease
affect the intensity and severity of
other disease in plants?

karishma,
[M.sc](#) (ll sem)
Meerut college, meerut

V

vaani 3:55 pm

Can we use plant gene inhibitors to
study plant physiological response to
abiotic factors

K

karishma 3:58 pm

thank you sir.

JT

Jyotsana Thakur 4:01 pm

Jyotsana Thakur Msc botany KMV
Jalandhar

Enter message here.

