



Molecular profiling of the *Sclerotinia sclerotiorum*- Brassica pathosystem for controlling stem rot disease in Mustard

Navin C Gupta^{1*}, Shaweta Arora¹, Sunita Yadav³,
Mahesh Rao¹, Pankaj Sharma², Dwijesh C Mishra³



¹**ICAR-National Institute for Plant Biotechnology (NIPB), New Delhi, India**

²ICAR-Directorate of Rapeseed and Mustard Research, Bharatpur, Rajasthan, India

³ ICAR-Indian Statistical Research Institute, New Delhi, India

[*navin.gupta@icar.gov.in](mailto:navin.gupta@icar.gov.in); navinbtc@gmail.com



Biotic stresses in Brassica

❖ Globally, a total of 16 diseases, 37 insect pests, several species of nematodes, and slugs cur

- 21% Yield

❖ *S. sclerotiorum*

-Pathogen

➤ One of the major

- Causes Stem
mustard

• Difficult to manage

- Hemibiotrophic

- Wind dispersed

- Longer persistence in soil

Stem rot



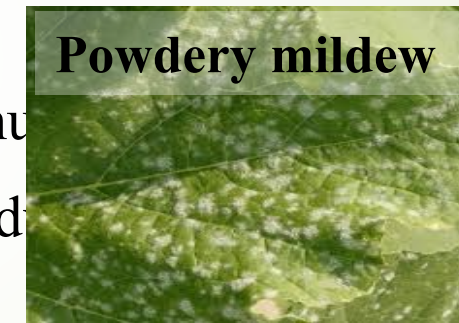
Alternaria blight



Orobanche



Powdery mildew



Downy mildew



White rust



Field	Reduction (%)
Test	- 66.37
ent	- 34.70
tein	- 38.95

	Changes (%)
	- 17.46
	- 18.12
Palmitic, stearic, linoleic and linolenic & eicosenoic acid	+ 63.05; 23.07; 48.55; 23.25; & 14.24





Multi-Omics Studies

Genetics & Genomics

- Genetic diversity studies
- ESR-01 WGS & annotation
- Secretome & Effectors prediction

Transcriptomics

- Screening Methodology
- Comparative transcriptomics
- Pathogen transcript recovery

Proteomics

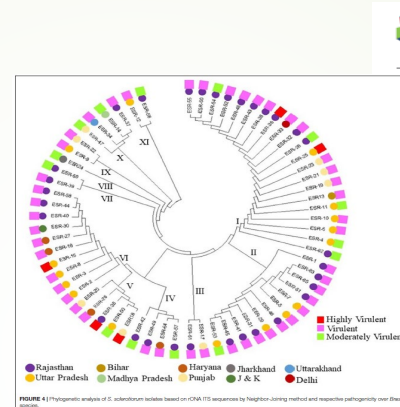
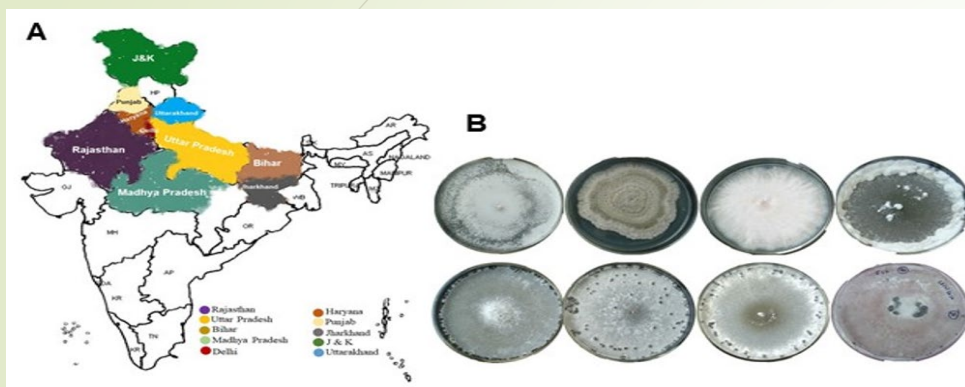
- Comparative Proteome
- Pathogen protein recovery

Metabolomics

- Host Secondary Metabolites (S / R lines & C / Inf)
- Pathogen SM

Genetics & Genomics

❖ 65 *S. sclerotiorum* isolates from 10 different states of India were analysed for their diversity



frontiers
in Microbiology

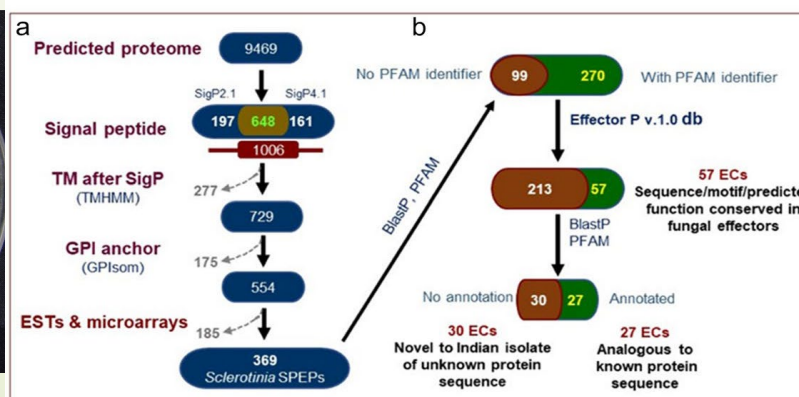
ORIGINAL RESEARCH
published: 05 June 2018
doi: 10.3389/fmicb.2018.01169

Check for updates

Genetic Diversity Studies Based on Morphological Variability, Pathogenicity and Molecular Phylogeny of the *Sclerotinia sclerotiorum* Population From Indian Mustard (*Brassica juncea*)

Pankaj Sharma¹, Amos Samkumar², Mahesh Rao², Vijay V. Singh¹, Lakshman Prasad², Dwijesh C. Mishra², Ramcharan Bhattacharya² and Navin C. Gupta^{2*}

❖ 57 (27 annotated and 30 novel) effectors of *S. sclerotiorum* 'ESR-01' an Indian isolate, were identified and their expressions were analysed



scientific reports

OPEN

Draft genome sequencing and secretome profiling of *Sclerotinia sclerotiorum* revealed effector repertoire diversity and allied broad-host range necrotrophy

Navin C. Gupta^{1,2,3*}, Sunita Yadav^{2,4}, Shaweta Arora^{2,4}, Dwijesh C. Mishra², Neeraj Budhlakoti², Kishore Gaikwad², Mahesh Rao², Lakshman Prasad², Pramod K. Rai⁴ & Pankaj Sharma^{2,5*}



S. Sclerotiorum Effector (SsEC) analysis



Ss Effectors	8h	16h	24h	Description	PFAM probable function
SsEC 5993	454.037	10039.04	1845.76	Phosphatidylglycerol phosphatidylinositol transfer	The MD-2-related lipid-recognition (ML) domain is implicated in lipid recognition
SsEC 3223	2.84	341.72	4865699238	Predicted protein	
SsEC 1603	0.33	194.46	313.72	Penicillium rubens	Membrane
SsEC 3860	7.09	110.4	193.12	Hypothetical protein, Panther superfamily	
SsEC 2609	0.38	58.22	35.42	d-tyrosyl-trnadeacylase	Cell growth inhibition
SsEC 7151	23.05	43.31	19.29	Related to gEgh16	Early infection stage in fungal pathogens

Screening Methodology

Journal of Microbiological Methods 175 (2020) 105983



ELSEVIER

Contents lists available at ScienceDirect

Journal of Microbiological Methods

journal homepage: www.elsevier.com/locate/jmicmeth



Bj NRCHB101

B. rapa

B. nigra

PJaikisan



Bj 1222-28 (RH6)

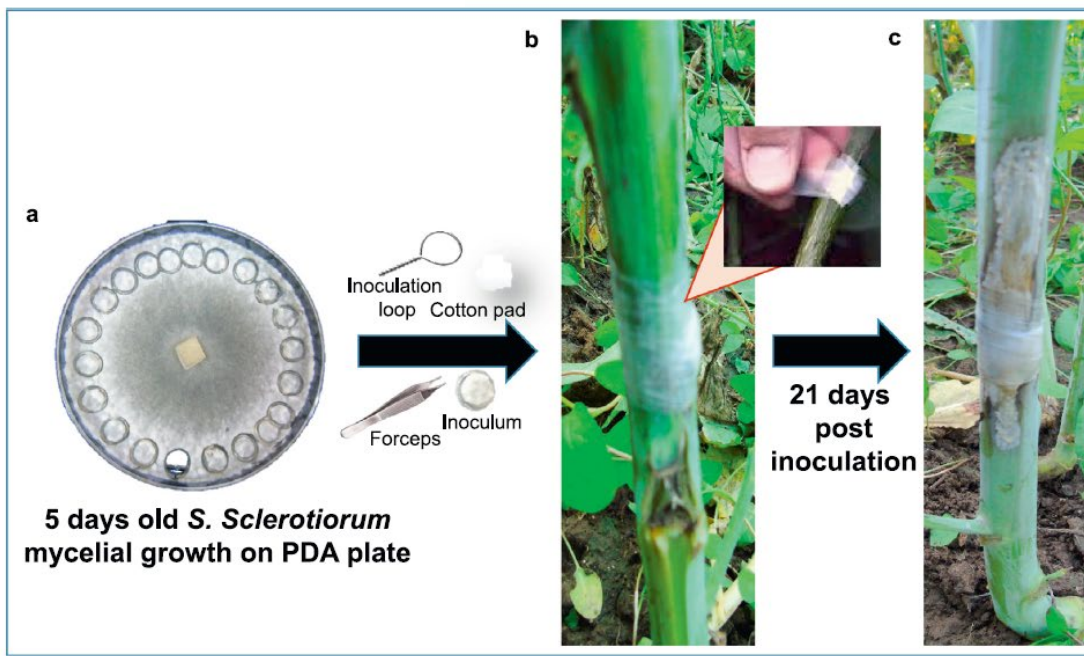
B. napus

B. carinata

Evaluation of non-injury inoculation technique for assessing *Sclerotinia stem rot* (*Sclerotinia sclerotiorum*) in oilseed Brassica

Navin Chandra Gupta^{a,*}, Pankaj Sharma^b, Mahesh Rao^a, Pramod Kumar Rai^b,

- 3 Stem assay (toothpick-mel
- 4 Petiole Inoculation Techni
- stage (1 ml Tip)
- 5 Intact stem assay at 50% t
- 6 Intact stem assay (modifie
- 7 Cotyledon assay
- 8 Stem inoculation
- 9 Detached stem assay
- 10 Immature Plant assay (Lea
- leaf stage)
- 11 Intact leaf assay at floweri
- 12 Detached petiole assay in
- 13 Detached leaf assay in 02-



t	<i>B. napus</i>	Zhao et al., 2004
	<i>B. napus</i>	Buchwaldt et al., 2005
	<i>B. napus</i> , <i>B. juncea</i>	Li et al., 2006
t	<i>B. napus</i>	Garg et al., 2008
	Oilseed Brassica	Barbetti et al., 2011
t	<i>B. oleracia</i>	Mei et al., 2012
t	<i>B. napus</i>	Taylor et al., 2015
t	<i>B. napus</i>	Thatcher et al., 2017
t	Brassica wild relatives	Taylor et al., 2018
t	Brassica wild relatives	Taylor et al., 2018

Brassica genotypes with considerable resistance

- IPR: Brassica germplasm registered for SR resistance



NIPB-Bnap114 (INGR22167)



NIPB-Bcar115 (INGR22168)



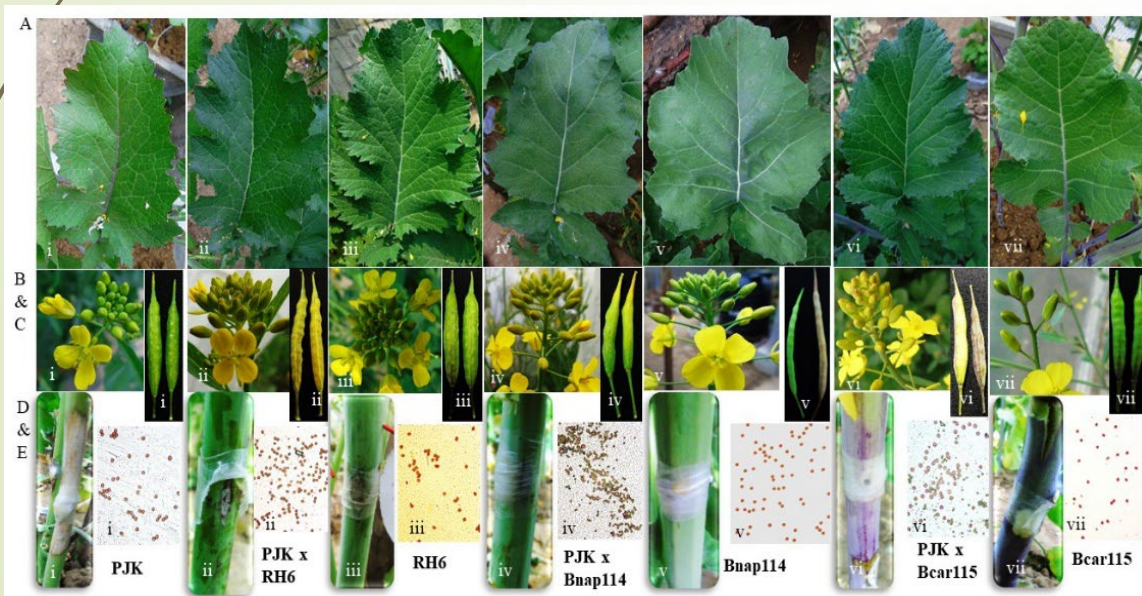
RH 122-28 (INGR22166)



Lsat 2



Susceptible



Research Article

Identification and Characterization of New Resistance Sources against Sclerotinia Stem Rot (*Sclerotinia sclerotiorum*) in Oilseed Brassica

Pankaj Sharma, Subaran Singh, V V Singh, NC Gupta¹, Laxman Prasad², P D Meena, Supriya Ambawat and P K Rai

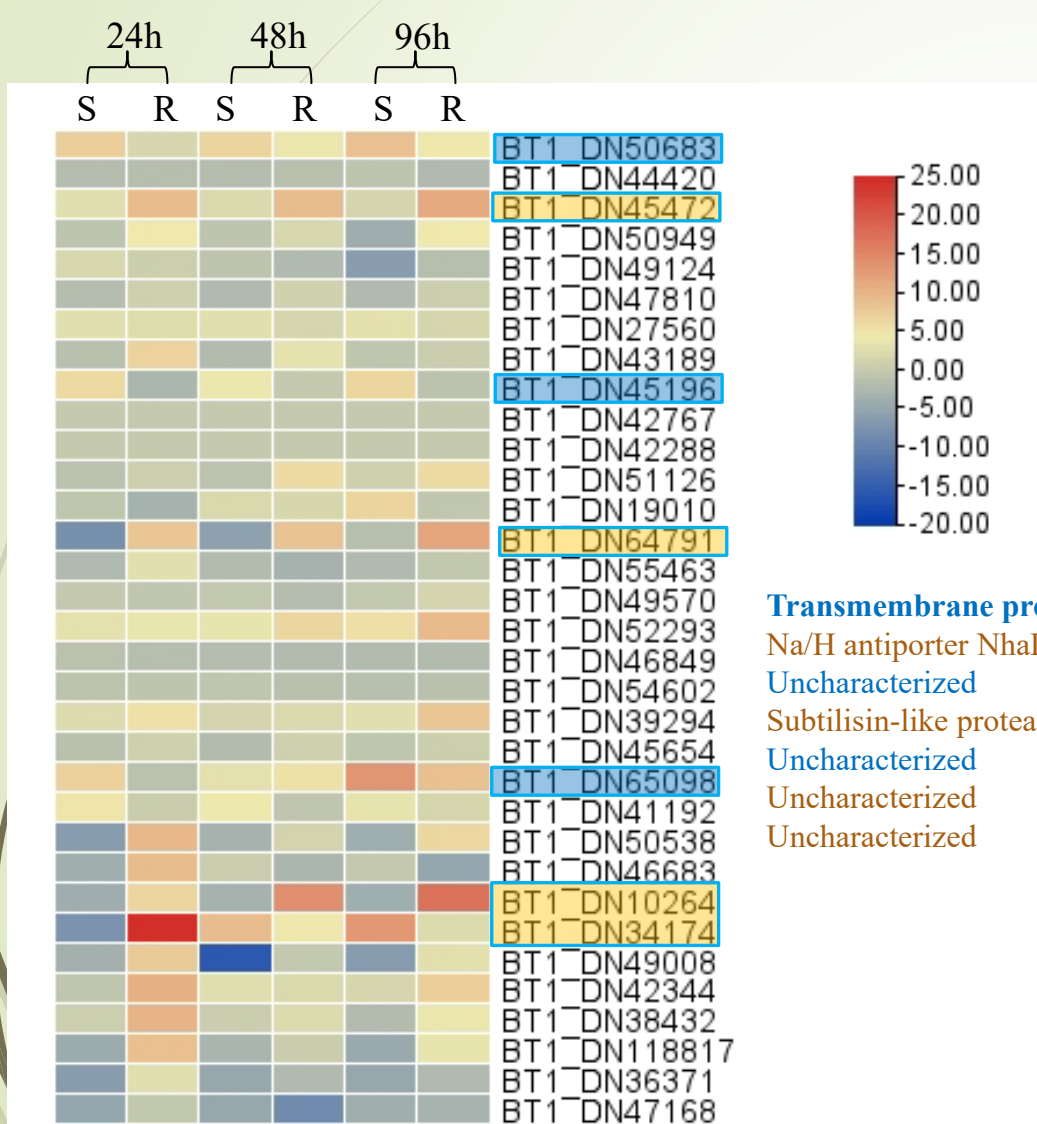


Combining the Sclerotinia stem rot disease resistance trait in interspecific hybrids of *Brassica napus* and *Brassica carinata*

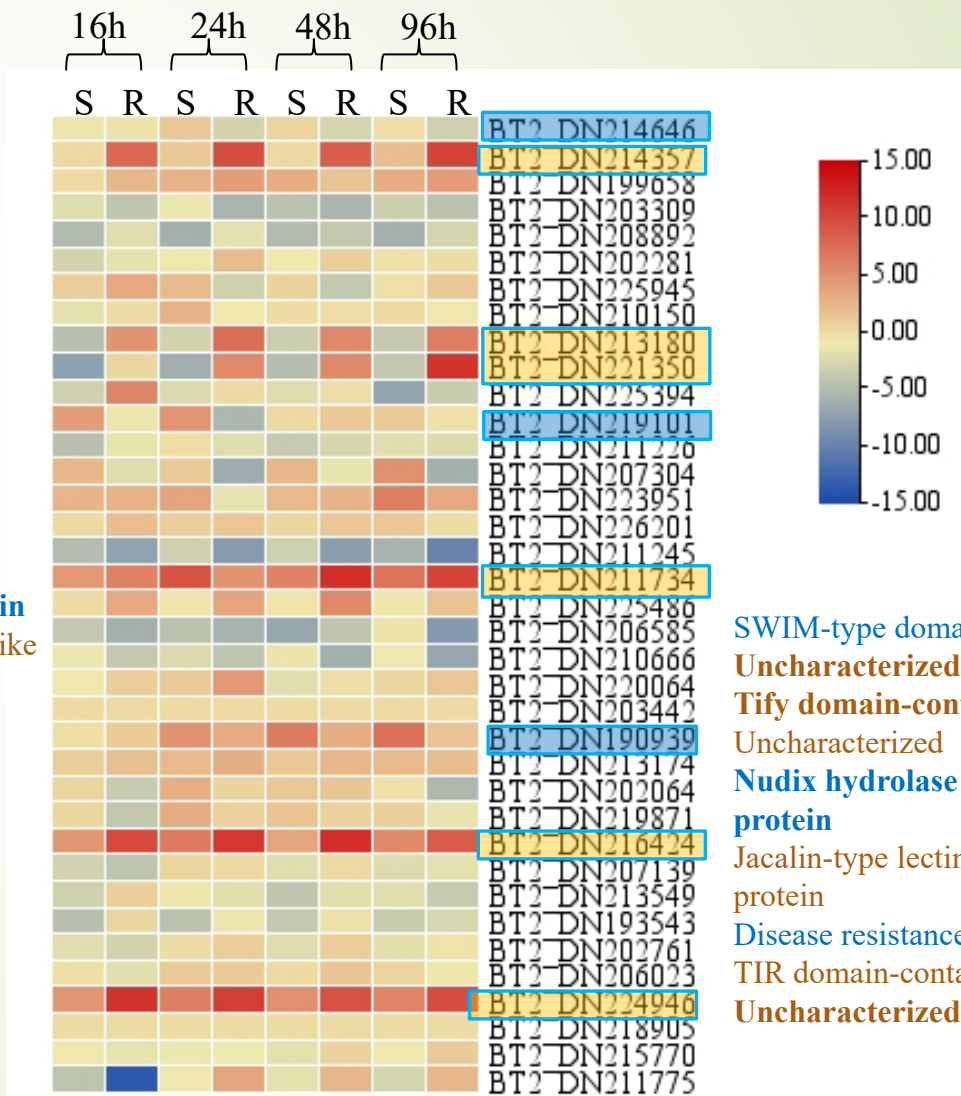
N.C. Gupta, R.K. Gupta, M. Rao and A. Kumar



Transcriptome profiling



Transmembrane protein
Na/H antiporter NhaD-like
Uncharacterized
Subtilisin-like protease
Uncharacterized
Uncharacterized
Uncharacterized



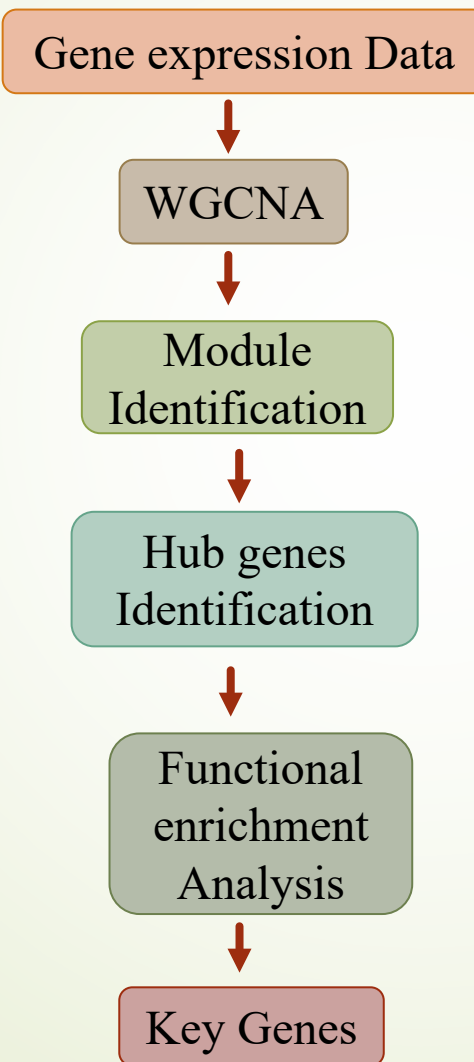
SWIM-type domain-containing protein
Uncharacterized
Tify domain-containing protein
Uncharacterized
Nudix hydrolase domain-containing protein
Jacalin-type lectin domain-containing protein
Disease resistance protein
TIR domain-containing protein
Uncharacterized



Recovered *S. Sclerotiorum* transcript

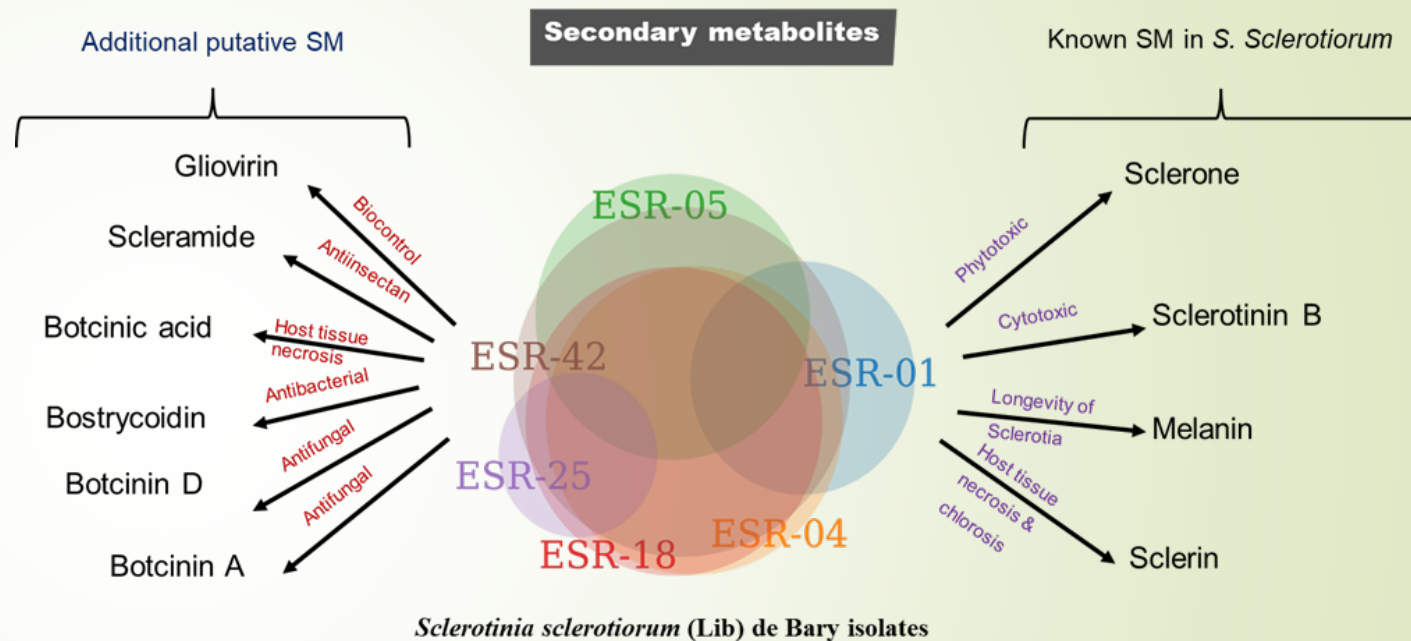
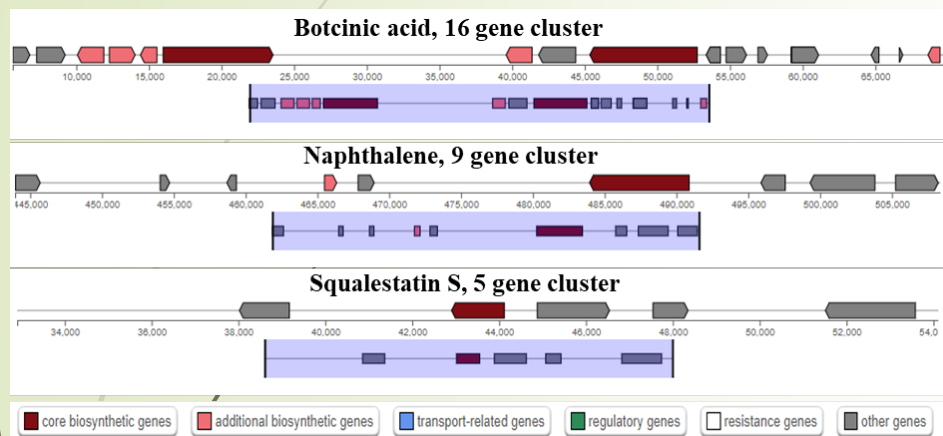


Gupta et al., Unpublished....



Gene	Function
Gene167	ATPase-coupled transmembrane transporter activity
Gene 2042	ATPase-coupled transmembrane transporter activity
Gene 3543	Hydrolase activity
Gene 5217	Pathogenesis
Gene 5535	Carbohydrate catabolic process
Gene 6752	ATPase-coupled transmembrane transporter activity
Gene 7092	Pathogenesis
Gene 7715	Carbohydrate metabolic process
Gene 5249	Hydrolase activity

Metabolome profiling of *Ss* under axenic condition



- ✓ The non-uniformity in SM release under axenic conditions showed it solely depends on the developmental behaviour, nutritive condition, and another environmental factor
- ✓ The pattern and extent of the SM released may change while interacting with the host



Thank you for your patience in listening



Acknowledgment

Collaborating Institutes:



NIPB



IARI



DRMR



IASRI

- Director, NIPB
- Professor MBB
- NIPB Colleagues
- Dr. Navinder Saini, IARI
- Dr. Pankaj Sharma, DRMR
- Dr. Dwijesh C Mishra, IASRI
- Students, SRF/JRF/Supporting staff



Funding agencies:



ICAR- Network Project on
Ag. Bioinfo. & Comp. Bio.



सत्यमेव जयते

DEPARTMENT OF BIOTECHNOLOGY
Ministry of Science & Technology
Government of India



सत्यमेव जयते



Science and Engineering Research Board (SERB)
Department of Science and Technology (DST)
Govt. of India

