WASHINGTON STATE UNIVERSITY

Department of
Entomology
COLLEGE OF AGRICULTURAL, HUMAN, AND NATURAL RESOURCE SCIENCES

Saumik Basu
Department of Entomology
Washington State University
Pullman, WA 99164
Saumik.basu@wsu.edu

Dear members of the search Committee,

I am writing to express my interest in a tenured faculty position at the level of assistant professor in the area of **Entomology** and **Plant pathology**. I am currently working as a postdoctoral research associate with Dr. David Crowder in the Department of Entomology at Washington State University and leading large-scale projects funded by USDA. My diverse educational background and research experience in Plant pathology and Entomology make me an excellent candidate for this position. In addition, I am proficient in establishing strong collaborations and my excellent communication skills are key success elements in conducting interdisciplinary research.

My research interests in Dr. Crowder's lab are largely directed toward understanding molecular, biochemical, physiological and ecological basis of different plant-insect-virus interactions. I am also investigating the role of soil microbes mediating complex interactions with aboveground attackers including both insects and pathogens. I am particularly interested to understand how the effects of multiple biotic stressors on host-plant (*Pisum sativum*) defense and quality depend on diversity of stressors and their order of arrival. I am also interested in investigating how soil mutualistic rhizobacteria mediate complex interactions among pea plants, a vector herbivore (aphids), a plant virus (*Pea enation mosaic virus*, PEMV) and non-vector chewing herbivore, *S. lineatus*. Besides my lead projects, I always take the opportunity to design and perform molecular and biochemical experiments for my fellow graduates and postdocs. Collaborating with their projects not only broaden my knowledge and expertise to work in diverse systems but also provide me an opportunity to work in diverse groups as team members.

As a predoctoral student in the laboratory of Prof. Supriya Chakraborty at Jawaharlal Nehru University (one of the prestigious and leading universities in India), I was trained in the fundamental methodologies to study intricate plant-pathogen interactions. My PhD research aided me in investigating roles of different host factors and viral proteins, which induced differential symptom expression in solanaceous hosts following tomato leaf curl geminivirus infection.

My first exposure to insect research begun when I started my first postdoctoral training under the supervision of Dr. Joe Louis at University of Nebraska-Lincoln. As a very first postdoc in Dr. Louis's lab, I had enough opportunities to work with various insects and study their interactions with diverse host species. During my training, I gained in-depth knowledge of insect rearing, insect colony maintenance and various intricate insect bioassays. I established standardized protocols which could benefit future students and postdocs. In addition to the field and

greenhouse research, I used molecular biology techniques to study various molecular and biochemical aspects of plant-insect interactions. In addition, I used RNAi as a key tool to investigate various insect genes and their role in mediating interactions with plants. Lastly, I leveraged RNA-seq and bioinformatics tools to examine the molecular response of herbivores and plants undergoing complex interactions.

My current postdoctoral position has broadened my horizon in research. I am fortunate to utilize my skills in molecular biology and bioinformatics to understand complex interactions of plants, herbivores/pathogens and soil microbial community as well as collaborate with group members. I am leading projects in different research areas: 1. Interactions between plant viruses, arthropod vectors and ecological communities 2. Reciprocal plant-mediated interactions between a plant virus and non-vector herbivore 3. Effect of niche partitioning between herbivores in spreading of vector-borne plant virus 4. Reciprocal antagonism between a plant virus and soil rhizobia in a legume crop. I primarily use various molecular, biochemical and physiological approaches to study complex multi-trophic interactions, to address fundamental molecular and physiological questions under ecological and evolutionary context. My ultimate research goal is to improve and develop pest management tactics based on sound knowledge in plant-insect-microbe interactions. Beside all my lead projects, I am also assisting various other projects including various aspects of potato-*Candidatus Liberibacter solanacearum*-potato psyllid interactions and effects of organic and synthetic fertilizer on insect herbivore populations in quinoa.

Along with research, I am active in teaching both undergraduate and graduate level courses in a wide range of subjects (refer to my CV). I was appointed as a guest lecturer at Dhruba Chand Halder College (an undergraduate college) affiliated with University of Calcutta, India, 2006-2007 in the Department of Microbiology. I also taught microbiology, biochemistry and molecular biology (both theory and practical in English) for undergraduate microbiology students. I instructed both **EMTOM 550-Insect Physiology** (as a co-instructor with **Dr. Laura Lavine**) and **PLP 511- Plant Virology** (as a guest lecturer) in the department of Plant Pathology at WSU during spring semester 2018. In addition, I interspersed the lectures with numerous active learning modules, e.g. in-class group reading/discussion and problem-solving exercises to promote teamwork and bolster their motivation. When instructing graduate level courses, I shifted the focus to theory-oriented, hypothesis-driven type learning to promote critical thinking. Currently, I am auditing **PLP 512-Bacterial genomics course** at WSU. In addition, I have mentored graduate and undergraduate students in my current lab with their projects involving molecular techniques. My primary goal is to always motivate students to consider the bigger picture and foster their academic independence through self-learning and in-depth discussion.

I am currently working in USDA grant “Exploring mechanism mediating plant-virus-herbivore interactions in legume crops” under the supervision of Dr. David Crowder (PI) and Clare Casteel from Cornell University. I am now actively involved in writing new grants on microbes and viruses on agricultural/natural ecosystem with my supervisor, Dr. David Crowder. I actively maintain collaborations with researchers across disciplines, including population geneticists, evolutionary biologists, and bioinformaticians, to bring their expertise to the research projects I lead.

I expect to develop an extramurally funded, nationally recognized program, conducting research employing molecular and ecological methodologies to advance Plant-insect-microbe researches in the field of agricultural entomology. I would contribute my knowledge and expertise to facilitate researches on insect microbial communities that influence insect ecology, fitness, metabolomics, evolutionary genomics, pathology, symbiosis, and/or pathogen infection and transmission. I strongly believe that with my research expertise and skills, I could focus on novel interactions of various microbes with insect pests and with various beneficial and/or invasive insect species. My positive attitude, excitement for research, communication skills, and broad collaborations would be assets to Department I will joining. Enclosed is my curriculum vitae. Please feel free to contact me for additional information on my background and qualifications. Thank you for your consideration.

Sincerely,

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Saumik Basu
358B, Department of Entomology,
Washington State University,
Pullman, Washington, USA
Email: saumik.basu@wsu.edu
Phone no: (402) 314-6601

Education

2007-2013	**Doctor of Philosophy** Molecular Plant pathology School of Life Science Jawaharlal Nehru University , New Delhi, India Laboratory of Dr. Supriya Chakraborty
2003-2005	**Master of Science** Biotechnology Visva Bharati University, Santiniketan, West Bengal, India
2000-2003	**Bachelor of Science** Physiology University of Calcutta Calcutta, India

Research and Training

Postdoctoral Research Associate (June 2017-Present) with Dr. David Crowder from Department of Entomology, Washington State University, Pullman, USA.
Project: Investigating molecular and biochemical aspects of pea-pea aphid-PEMV interactions
Postdoctoral Research Associate (July 2014- May 2017) with Dr. Joe Louis from Department of Entomology, University of Nebraska-Lincoln, Nebraska, USA.
Project: Molecular, biochemical and physiological aspects of various plant-herbivore interactions

Awards and Grants

1) Qualified prestigious **National Eligibility Test** for combined Junior research fellowship and lectureship (**NET-JRF**) jointly conducted by Council for Scientific and Industrial research (CSIR) and University Grants Commission (UGC), Govt. of India, in June 2007 and December 2007.

2) Awarded **Foreign travel grant** (**70000 Japanese yen**) from International Union for Microbiological Societies (IUMS) for presenting my research in IUMS 2011, XV, International Congress of Virology, Sapporo, Japan, during 11 – 16 September.

3**) Best Oral presentation** at Prof. N J Narasimhan Academic Merit Award Contests of Agricultural Research Institute (IARI), New Delhi-110012 on 13th Indian Phytopathological Society, Delhi zone at National symposium on "Functional strategies for tackling emerging diseases of major crops" held at plant pathology Division, Indian, December 2013.

4) Awarded **Erasmus Mundus Brave Postdoctoral Scholarship** provided by European Union for carrying out postdoctoral research in the field of plant virology in Germany in 2014 (Not availed).

Publications

1) **Basu S**, Clark RE, Lee BW, Blundell R, Casteel CL, Crowder DW. Reciprocal antagonism between a plant virus and rhizobial bacteria in a legume crop (under revision in **Functional Ecology**).

2) **Basu S**, Clark RE, Casteel CL, Crowder DW. Assessing the role of chemical defense and plant nutrients in mediating plant-insect-pathogen interactions (ready for submission in **molecular ecology**).

3) Chisholm PJ, Eigenbrode SD, Clark RE, **Basu S**, Crowder DW. (2019). Plant-mediated indirect interactions between a vector and a non-vector herbivore promotes the spread of a plant virus. **Proceedings of Royal society B**. PMID: 31551062. Doi:10.1098/rspb.2019.1383.

4) **Basu S**, Pereira AE, Pinheiro DH, Wang H, Siegfried BD, Louis J, Vélez AM (2019). Evaluation of reference genes for expression analysis using quantitative real-time PCR in southern corn rootworm, *Diabrotica undecimpunctata howardi* (Barber). **Scientific Reports.** PMID: 31341190. DOI: 10.1038/s41598-019-47020-y.

5) Palmer NA, **Basu S**, Heng-Moss T, Bradshaw JD, Sarath S, Louis J (2019). Fall armyworm (*Spodoptera frugiperda* Smith) feeding elicits differential defense responses in upland and lowland switchgrass. **PLoS ONE**. PMID: 31194847. DOI: 10.1371/journal.pone.0218352.

6) Clark RE, **Basu S**, Lee BW, Crowder DW. (2019). Tri-trophic interactions and non-vector herbivores determine the spread of vector-borne pathogens through trait- and density-mediated mechanisms. **Ecology**. PMID: 31482568. DOI: 10.1002/ecy.2879.

7) **Basu S**, Kumar Kushwaha N, Kumar Singh A, Pankaj Sahu P, Vinoth Kumar R, Chakraborty S. (2018). Dynamics of a geminivirus encoded pre-coat protein and host RNA- dependent RNA polymerase 1 in regulating symptom recovery in tobacco. **J Exp Bot.** PMID: 29432546 DOI: 10.1093/jxb/ery043.

8) **Basu S**, Varsani S, Louis J. (2018). Altering Plant Defenses: Herbivore-Associated Molecular Patterns and Effector Arsenal of Chewing Herbivores. **Mol Plant Microbe Interact**. PMID: 28840787. DOI: 10.1094/MPMI-07-17-0183-FI. Epub 2017 Oct 12.

9) Ray S, **Basu S**, Rivera-Vega LJ, Acevedo FE, Louis J, Felton GW, Luthe DS. (2016). Lessons from the Far End: Caterpillar FRASS-Induced Defenses in Maize, Rice, Cabbage, and Tomato. **J Chem Ecol**. PMID: 27704315 DOI: 10.1007/s10886-016-0776-x.

10) Varsani S, **Basu S,** Williams WP, Felton GW, Luthe DS, Louis J. (2016). Intraplant communication in maize contributes to defense against insects. **Plant Signal Behav**. PMID: 27467304 DOI: 10.1080/15592324.2016.1212800.

11) Louis J, **Basu S**, Varsani S, Castano-Duque L, Jiang V, Wiiliams WP, Felton GW, Luthe DS. (2015) Ethylene contributes to mir1-mediated maize defense against the phloem-sap sucking corn leaf aphid. **Plant Physiol**. PMID: 26253737 DOI: 10.1104/pp.15.00958.

12) Kumar RV, Singh AK, Singh AK, Yadav T, **Basu S**, Kushwaha N, Chattopadhyay B, Chakraborty S. (2015). Complexity of begomovirus and betasatellite populations associated with chilli leaf curl disease in India. **J Gen Virol**. PMID: 26251220 DOI: 10.1099/jgv.0.000254.

13) Sharma VK, **Basu S**, Chakraborty S. (2015). RNAi mediated broad-spectrum transgenic resistance in *Nicotiana benthamiana* to chilli-infecting begomoviruses. **Plant Cell Rep**. PMID: 25916177 DOI: 10.1007/s00299-015-1795-8.

14) Kushwaha N, Singh AK, **Basu S**, Chakraborty S. (2015). Differential response of diverse solanaceous hosts to tomato leaf curl New Delhi virus infection indicates coordinated action of NBS-LRR and RNAi-mediated host defense. **Arch Virol**. PMID: 25894479 DOI: 10.1007/s00705-015-2399-x.

15) Sharma VK, Kushwaha N, **Basu S,** Singh AK, Chakraborty S. (2015). Identification of siRNA generating hot spots in multiple viral suppressors to generate broad-spectrum antiviral resistance in plants. **Physiol Mol Biol Plants**. PMID: 25648440 DOI: 10.1007/s12298-014-0264-0.

16) Ranjan P, Singh AK, Kumar RV, **Basu S,** Chakraborty S. (2014). Host-specific adaptation of diverse betasatellites associated with distinct Indian tomato-infecting begomoviruses. **Virus Genes**. PMID: 24384936 DOI: 10.1007/s11262-013-1031-y.

Book Chapter

Basu S, Sharma VK, Bhattacharyya D, Chakraborty S. (2014) An overview of antiviral RNA in plant: biogenesis, host-virus interaction and potential applications. "Approaches to Plant Stress and their Management". Springer Verlag publishers. DOI 10.1007/978-81-322-1620-9_18.

Manuscripts under Preparation

- **Basu S**, Clark RE, Fu Z, Crowder DW. Insect alarm pheromones in response to predators: molecular mechanisms and ecological trade-offs in food web interactions (In preparation).
- **Basu S**, Jiménez AV, Neetha V, Velez AM, Louis J. Detection of β-glucosidase activity in *Diabrotica virgifera virgifera* and effect of Glycoside hydrolase I mediated RNAi on βglucosidase activity (In preparation for Scientific Reports).
- **Basu S**, Varsani S, Louis J. Jasmonic acid contributes to PAD4 mediated defense in *Arabidopsis* against the chewing herbivore Cabbage loppers (In preparation).
- **Basu S**, Singh D, Sahu S, Chakraborty S. AC2 and AV2 ORFs of Tomato leaf curl Gujarat virus promote asymmetric synergism with Tomato leaf curl New Delhi virus (In revision for Virus research).

- **Basu S**, Malhotra P, Crowder DW, Casteel CL. Diversity of viral suppressors in tomato infecting viruses: structural and functional analysis of counter-defense and pathogenicity in tomato (In preparation).
- Lee BW**, Basu S**, Casteel CL, Crowder DW. Predation risk and conspecific alarm cues affect pea aphid vector competence during complex multi-trophic interactions (In preparation).
- Oeller E, **Basu S**, Lee BW, Crowder DW. Effects of organic and synthetic fertilizer on insect herbivore populations in quinoa (In preparation).
- Cohen A, **Basu S**, Crowder DW. Transmission of an insect-vectored plant pathogen involves the interaction between the plant, the pathogen, and the vector (In preparation).

Gene Bank Submission of Viral Sequences

- **Basu S,** Singh AK, Chattopadhyay B and Chakraborty S. 2010. Pepper leaf curl Bangladesh Virus-India [India: Mograhat:2007] DNA-A, complete sequence. Submitted to NCBI GenBank accession no HM007111.
- **Basu S**, Singh AK, Chattopadhyay B and Chakraborty S. 2010. Tomato leaf curl Joydebpur betasatellite [India: Mograhat: Chilli:2007] DNA, complete sequence. Submitted to NCBI GenBank accession no HM007112.

CONFERENCE PROCEEDINGS

✓ Lee BW, **Basu S** and Crowder DW. Predation risk and conspecific alarm cues affect pea aphid vector competence for *Pea enation mosaic virus* during complex multitrophic interactions. Entomological society of America meeting held at St. Louis, USA on November 18, 2019 (**Awarded 1st position**).

✓ Clark RE, **Basu S**, Lee BW and Crowder DW. Tri-Trophic interactions mediate the spread of a vector-borne plant pathogen. Ecological Society of America meeting held at New Orleans, LA on August 8, 2018.

✓ Singh AK, Kushwaha NK, **Basu S** and Chakraborty S. RDR1 of *Nicotiana tabacum* promotes methylation of viral promoter and recovers plant from ToLCGV infection. In: Science Day held at JNU, New Delhi on February 28, 2018.

✓ Singh AK, Kushwaha NK, **Basu S** and Chakraborty S. Arm race between pre-coat protein of geminivirus and RDR1 of *Nicotiana tabacum* for symptom development and recovery. In: Indian Phytopathological Society National Symposium & Delhi Chapter Meeting on Innovative Strategiesfor the Management of Plant Disease Under Climate Change Scenario held at Division of Plant Pathology ICAR-Indian Agricultural Research Institute, New Delhi, India on December 19, 2017, P. 40.

- ✓ Singh AK, **Basu S**, Kushwaha NK, Sahu PP, Kumar RV and Chakraborty S. Precoat protein of geminivirus regulates symptom recovery through dynamic interplay with host RNA dependent RNA polymerase 1 in tobacco. In: 86th Conference of Society of Biological Chemists held at JNU, New Delhi during November 16 – 19, 2017, P.364.
- ✓ **Basu S**, Varsani S, Neetha N V, Eyun S I, Riethoven J J and Louis J. Transcriptome responses in maize-western corn rootworm interaction: a two-way approach. International congress of Entomology meeting in September 2016 at Orlando, Florida.
- ✓ **Basu S**, Varsani S, Eyun SI, Riethoven JJ and Louis J. Maize transcriptional response to insect herbivory. ESA meeting in November 2015 at Minneapolis, MN, USA.
- ✓ **Basu S**, Kushwaha N, Sahu PP, Singh AK, Vinoth kumar R, and Chakraborty S. 2015. Arm race between plant and virus: Host recovery from ToLCV infection visàvis RNAi suppression. In: 56th Annual Conference of Association of Microbiologist in India (AMI 2015) & International Symposium on "Emerging Discoveries in Microbiology" held at Jawaharlal Nehru University, New Delhi during December 7-10.
- ✓ **Basu S**, Kushwaha, N and Chakraborty S. Differential pathogenicity of Tomato infecting begomoviruses elucidates critical role of AV2 in blocking PTGS mediated host recovery. In: the 7th International Geminivirus Symposium and 5th International ssDNA comparative Virology Workshop held at Zhejiang, Hangzhou, China during November 3-9, 2013, P.99 (invited lecture) *
- ✓ **Basu S**, Sharma V K, Singh D, Chakraborty S. Interaction between AV2 and NtSGS3/ SlSGS3 is indispensable for pathogenesis of tomato-infecting begomoviruses. In: Asia – Pacific congress of Virology, held at Amity University, New Delhi, India during 17-20, December 2013. P. 91.
- ✓ **Basu S,** Singh D, Sahu S, Chakraborty S. Identification of viral factor(s) governing synergistic interaction among tomato-infecting begomoviruses in India. In: Asia –Pacific congress of Virology, held at Amity University, New Delhi, India during 17-20, December 2013. P. 90. 38
- ✓ **Basu S** and Chakraborty S. 2011. Role of PTGS Suppressors of *Tomato leaf curl New Delhi virus* during pathogenesis. In: The International Congress on Virology, held at Sapporo, Japan during September 11-16.
- ✓ **Basu S**, George B and Chakraborty S. Identification of post transcriptional gene silencing (PTGS) suppressors in *Tomato Leaf Curl New Delhi Virus* (ToLCNDV). In: Conference on Whitefly and thrips transmitted viruses, to be held at UDSC, New Delhi during August 27-28, 2010.
- ✓ Chakraborty S, Singh A K, Chattopadhyay B, Kushwaha N, Vinoth Kumar R, **Basu S.** Chilli leaf curl disease is caused by interaction among diverse Begomoviruses in

India. In: The sixth Solanaceae genome workshop, held at New Delhi during November 8-13, 2009.

Career Development

- Attended full day ORAP grant writing workshop (Hands on and Interactive) at Washington state University, Pullman, WA on 21st November 2019.
- Currently auditing **PLP512-Bacterial genomics course** at WSU to learn new molecular and bioinformatics tools to study host-microbe interactions.
- Attended workshop on "Scientific writing and bioethics" held on Sept 20th-21st 2012 at School of Life Sciences, Jawaharlal Nehru University, New Delhi.
- Attended workshop conducted by Springer and Edanz in collaboration with Jawaharlal Nehru University on "How to write for and get published in scientific journals and publish manuscript" held on Aug 27, 2012 at Jawaharlal Nehru University, New Delhi.
- Attended workshop conducted by Wiley in collaboration with Jawaharlal Nehru University on "Authors workshop" held on Sept 20, 2012 at Jawaharlal Nehru University.
- Attended Indo-US workshop on Epigenetic Regulation and Genome Control (Emphasis on RNAi and miRNA) held during December 16-18, 2009 at Centre for Cell and Molecular Biology (CCMB), Hyderabad-500007, India.

Teaching and Mentoring Experience

2006-2007	Guest lecturer at Dhruba Chand Halder College (an undergraduate college) affiliated with the University of Calcutta, India, in the **Department of Microbiology** **Responsibilities:** Taught microbiology, biochemistry and molecular biology classes (both theory and practical in English) for under graduate microbiology students
Spring 2019	**EMTOM 550, Insect Physiology** (as a co-instructor with **Dr. Laura Lavine**) at WSU in the **Department of Entomology**
Spring 2019	**PLP511- Plant Virology** (as a guest lecturer) at WSU in the **Department of Plant Pathology** Training undergraduates, graduates and fellow postdocs in the lab and department of how to use various molecular techniques in their respective fields of entomology and ecology researches.

Extracurricular Activities

- Served as a volunteer in the Insect Expo held during April 2019
- Served as a Judge in Research Expo Poster Competition organized by Graduate and Professional student associated (GPSA) during April 2019
- Judged Poster Competition at WSU Plant Science Symposium held during March 2019.
- Severed as a volunteer in BugFest organized by the Department of Entomology, University of Nebraska Lincoln during September 2015 and 2016.
- Participated actively in organizing 'Biosparks 2010', 8th annual research festival of School of life sciences of Jawaharlal Nehru University, New Delhi during 11-12th march,
- 2010.
- Actively participated and organized several cultural programs and sports events of Jawaharlal Nehru University.

Memberships and Affiliations

- AAAS member through the AAAS/Science Program for Excellence in Science
- Entomological Society of America
- International Society of Chemical Ecology
- International Society for Molecular Plant-Microbe Interactions
- Lifetime member of Society of Biological Chemists, India [SBC (I)].
- Member of Indian Phytopathological Society

Reviewer

1) Journal of Applied Entomology
2) Arthropod-plant interactions
3) Science alert
4) Molecular Biology Reports
5) Annals of applied biology
6) 3 Biotech
7) Bio-protocol journal

References

Dr. David Crowder
Associate Professor
Department of Entomology
Washington State University
Pullman, WA 99164-6382
Phone: (509) 335-7965
Email: dcrowder@wsu.edu

Dr. Laura Lavine
Professor and Chair
Department of Entomology
Washington State University
Pullman, WA 99164-6382
Phone: (509) 335-0481
Email: lavine@wsu.edu

Dr. Clare Casteel
Associate Professor
School of Integrative Plant Science
Plant pathology and Plant-Microbe Biology Section
Cornell University
Ithaca, NY 14853-5904
Email: clc269@cornell.edu

Dr. Joe Louis
Associate Professor
Department of Entomology
University of Nebraska-Lincoln
Lincoln, NE 68583-0816
Phone: (402) 472-8098
Email: joelouis@unl.edu