“Development of gluten reduced wheat product using indigenous lactic acid bacteria for Celiac Disease”

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Abstract

Probiotics are increasingly being used as nutraceuticals, functional foods or in microbial interference treatment. Probiotics have also been suggested for the development of gluten reduced wheat foods for celiac disease prone patients conferring overall intestinal health in addition to alleviating the burden of gluten intolerance. Exploring new indigenous gluten hydrolyzing bacteria from wheat sourdough and curd samples was felt beneficial in fulfilling the aim of the present study to develop gluten reduced wheat foods using potential indigenous probiotics.

In the present study, the gluten hydrolyzing bacteria isolated from wheat sourdough as well as curd samples have been screened for their probiotic potentiality. *In vitro* studies using Caco-2 cells revealed adhesion and prevention of pathogen invasion abilities of all the tested strains. Further, none of the tested isolates exhibited antibiotic resistance and hemolytic activity. However, the isolates could survive gastric transit, auto aggregate and exhibited good coaggregation as well as antimicrobial properties. All these characteristics of gluten hydrolyzing bacterial isolates GS 33, GS 143, GS 181 and GS 188 belonged to *Bacillus* spp. suggesting their ability to survive upper gastrointestinal stress and to adhere GI tract establishing barrier against pathogens, conferring health benefit to the host and therefore, they could be promising gluten hydrolyzing probiotic candidate. Further, hydrolysis of celiac epitope derived tripeptides indicated the potentiality of the tested isolates to cleave immunogenic peptides and thereby reduce immunogenicity and it was further confirmed by LC MS/MS analysis. The results indicated that multiple epitopes in

gliadins would be targeted by the tested isolates, credibly destroying their gliadin specific T cell inducing activities. While the human digestive enzymes are unable to reduce gluten immunogenicity, the tested *Bacillus spp.* indigenous to wheat were showed promising gluten hydrolysis. Therefore, the indigenous *Bacillus* spp. chosen in the present study perhaps be a competitive, safe and promising gluten hydrolyzing candidate.

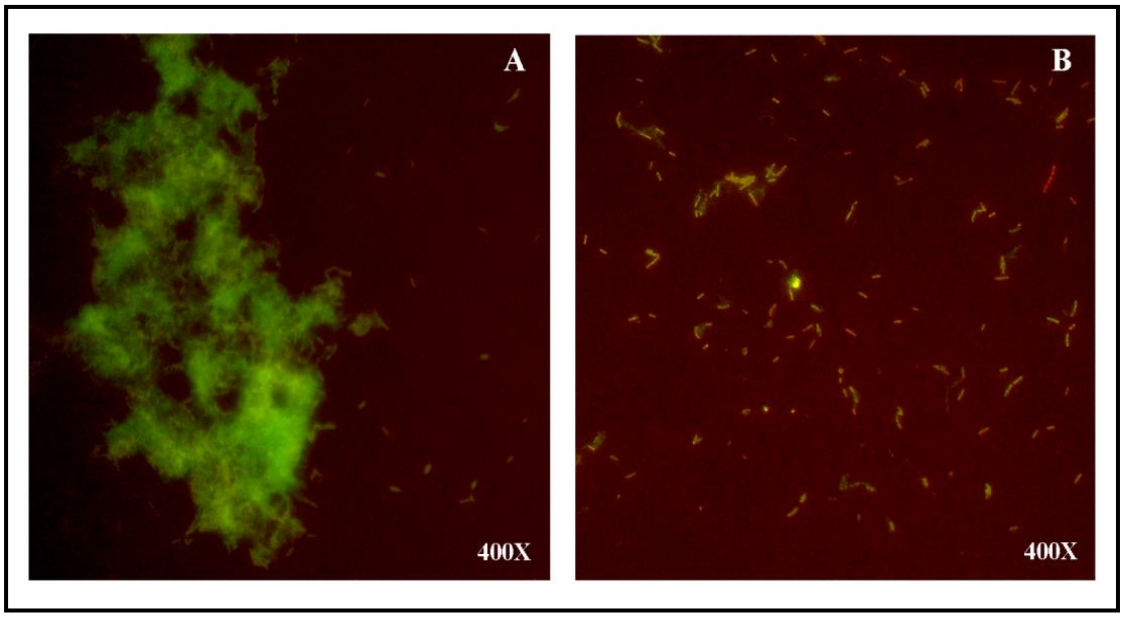


Figure1: Fluorescent microscopic image showing autoaggragation of GS 143. A: Autoaggregation of GS 143 isolate without pretreatment.

B: autoaggregation of GS 143 isolate pretreated with pepsin

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Biography

Dr Gayathri Devaraja, currently working ass Professor, Chairperson and Dean, Department of Microbiology, Davangere University, Davagere-577002, India, completed her Master degree in Microbiology and Ph D from Mangalore University, India (2004). She has 22 years of teaching and research experience. Her research area of specialization includes Cell culture, Probiotics, production of monoclonal antibodies for diagnosis and Bioremediation. Dr Gayathri has published more than 40 papers in national and international journals. She has been awarded with national international awards for her research excellence and won best participant award during International workshop at International Vaccine Institute, Seoul, South Korea, in addition to best paper award and Talented Teachers award etc. She has travelled, Malaysia, South Korea, Hong Kong etc for international work shop or seminars.

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Davanagere 577002, India.



Academic Qualifications:

Period	Course	Institute	Result
1998-2002	Ph.D.	Dept. of Biosciences, Mangalore University, Mangalore.	Awarded doctorate
1994 - 1996	M.Sc. Microbiology	Post-graduate Centre, Kuvempu University, Davanagere.	71.77%, I Class with Distinction
1991-1993	B.Sc.	JCBM College, Sringeri, Kuvempu University.	68%, I Class
1996	NET/SLET	UGC, New Delhi	Qualified in Microbiology

Professional Experience:

- **Teaching –**
- **Professor,** Department of studies in Microbiology, Davanagere University, Shivagangothri, Tholahunase, Davanagere 577002, 29th August 2012 to tilldate
- **Associate Professor,** Department of studies in Microbiology, Davanagere University, Shivagangothri, Tholahunase, Davanagere 577002, 29th August 2009 to 28th August 2012.
- **Associate Professor & Chairperson,** Department of studies in Microbiology, Davanagere University, Shivagangothri, Tholahunase, Davanagere 577002, India. 18 Jan 2012 to 17th Jan 2014.
- **Associate Professor,** Department of studies in Microbiology, Davanagere University, Shivagangothri, Tholahunase, Davanagere 577002, India. 2 Dec 2009 to 17 Jan 2012.
- **Reader & Chairperson,** Department of studies in Microbiology, Davanagere University, Shivagangothri, Tholahunase, Davanagere 577002, India. 6 August 2008 to 2 Dec 2009
- **Reader & Chairperson,** Department of studies in Microbiology, Davanagere University, Shivagangothri, Tholahunase, Davanagere 577002, India. 6 August 2008 to till date.
- **Reader & Chairperson,** Department of studies in Microbiology, Kuvempu University, Jnana Sahyadri, Shankaraghatta 577451, 29 August 2006 5 August 2008.
- **Lecturer (Senior Scale),** Department of Microbiology, University College, Mangalore, 8 August 2003 to 28 August 2006.
- **Lecturer**, Department of Microbiology, University College, Mangalore, 96'to 7 Aug '03.

2. Research -

- **Doctoral Researcher:** Laboratory of Biotechnology and Pathology, Department of Aquaculture, College of Fisheries, Mangalore from 1998 to 2002.

Additional Academic Positions:

- **Syndicate member: Davangere University,** 18th January 2018 to till date
- **Dean, Faculty of Science and Technology,** Davangere University 1 April 2017 to till date.
- **Chairperson,** Dept of Microbiology, Davangere University. 18th January 2018 to till date.
- **Co-ordinator,** Dept. of Biotechnology, Davangere University, since July 2017
- **Co-ordinator,** Dept. of Botany, Davangere University,2011-12, 2012-13. 2013-14.
- **Co-ordinator,** Dept. of Zoology, Davangere University. 2013-14.
- **Chairperson, BoS,** Dept of Biotechnology, Davangere University, since February 2018
- **Chairperson, BoS,** Dept of Microbiology, Davangere University. 2014-2018
- **Chairperson, BoS,** Dept of Botany, Davangere University. 2014-2018

- **Warden,** Ladies Hostel, Davanagere University, Davanagere, December 2011 to Jan 2014. October 2014 to till date.
- **Chairperson,** Department of studies in Microbiology, Kuvempu University P G Centre, Tholahunase, Davanagare-577002, 20 September 2008 to 2 Dec 2009.
- **Chairperson, P G BOE.** 2008-09. 2011-12
- **Warden,** Ladies Hostel, P G Centre, Davanagere, December 2008-09.
- **Chairperson,** Department of studies in Microbiology, Kuvempu University, Jnana Sahyadri, Shankaraghatta 577451, September 2006 to 5 August 2008.
- **Member**, Board of Examiners for Microbiology (PG), Kuvempu University, Jnana Sahyadri, Shankaraghatta. 2006-07, 2007-08, 2008-09
- **Member**, Board of Examiners for Microbiology (PG), Davangere University, Shivagangothri, Tholhunse, Davanagere. 2009-10, 2010-11, 2011-2012. 2012-13
- Member, BoE for Microbiology (PG), Karnatak University 2011-12,
- Member, BoE for Microbiology (PG), Bangalore University 2011-12. 2016-17, 18
- Member, BoS for Microbiology (UG), Karnatak University 2013-14,
- **Head**, Department of Microbiology, University College, Mangalore. August 1997 to 28 August 2006.
- **Coordinator**, Microbiology Practical Examination (UG) 2003-04, Mangalore University, Mangalagangothri.
- **Member**, Board of Examiners for Microbiology Examination (UG), Mangalore University, 1998-99, 1999-2000, 2001-2002, 2002- 2003, 2003-2004, 2004-2005.2002-06
- **Chairperson,** Board of Examiners for Microbiology Examination, Mangalore University, 2005-2006.
- **Head**, **Water Testing Centre**, Microbiological examination of water, Department of Microbiology, University College, Mangalore. September 2004 to 28 August 2006.

Memberships In Professional Organisations:

1. International Member, ***American Society of Microbiology***
2. International Member, ***Korean Society of Microbiology and Biotechnology***
3. Member, ***Indian Science Congress*** (2016 onwards)
4. Executive Member, ***Association of Microbiologists of India (AMI)***
5. Member, ***Mycological Society of India (MSI)***
6. Executive Member, ***Microbiology Teachers Association***, Mangalore
7. Life Member, ***Swadeshi Vignana Andolana-Karnataka*** (SVAK-046 8/LM-DVG)

Research Projects: Principal Investigator

- "Efficacy of monoclonal antibody based immunodot test for the detection of *A. invadans* of EUS of culture ponds". March 2005 to 2008. UGC sponsored Minor Research Project.N. Delhi. Rs. 1, 00, 000/ **Completed.**

- Investigation on indigenous bacteria for biodegradation of polychlorinated biphenyls from industrial effluents. May 2009 to April 2012. UGC sponsored Major Research Project. New Delhi. **Rs. 9, 03, 300/, Completed.**
- Irradiation effect on lichen symbionts for the improvement of soil fertility from Chitradurga fort area Karnataka. April 2013 to June 2016. DAE-BRNS sponsored Research project. **Rs.** . **Rs.16, 36, 025. Completed.**
- Development of gluten free wheat foods using potential indigenous Lactobacillus spp. 14th November 2013 to 14 November 2016, DBT R&D Project, N Delhi, **Rs. 23, 00, 000. Ongoing**
- **Research Fund for Talented Teachers:** Evaluation of restorative effect and Tight junction barrier strengthening in Caco-2 celllines using Probiotic cells for celiac disease. **Vision Group Science and Technology, Govt of Karnataka, 2016-17 Rs. 3.00 Lakhs, Ongoing**

Student Projects: sponsored by KSCST, Govt of Karnataka, Indian Institute of Science, Bangalore

- Effect of Pongemia cake on beneficial soil microorganisms in Areca nut plantation. April 2013-July 2013, Karnataka State Council for Science and Technology (KSTA), **Rs. 15, 000. Completed.**

- Composition of methanotrophs in paddy field and effect of pomgemia cake, a by product of biofuel production. March to May 2017, Rs. 10,000, **Completed**
- **On going**
  Efficacy of Pongamia oil based soap against conventional soaps with respect to antibacterial activity to encourage hygiene practice among rural folk. March to July 2018, Rs. 12,500,

Visits to other countries: Malaysia (2002-03), South Korea (2012), Hong-Kong (2012).

Ph D Awarded: 05

1. Asha, "Evaluation of Lactobacillus sp with vincristine for colorectal cancer in mice system" Kuvempu University, awarded Ph D on **20th February 2012.**

2. Shobha K Jayanna"Polychlorinated Biphenyl Degradation using indigenous bacteria from industrial effluents", **Kuvempu University,** awarded on **3rd Nov 2014**

3. Somaraja P K, "Bioremediation of polychlorinated biphenyls; A nano biotechnological approach" Davangere University, awarded **on 18th December 2017**

4. Rashmi B S, "Development of Gluten Reduced Wheat Product Using Indigenous Lactic Acid Bacteria for Celiac Disease" awarded on **27th January 2018**

5. Swamy C T, "Lichen associated bacteria and their role in plant growth promoting properties" awarded on **3rd February 2018**

Submitted Ph D thesis;

Ph D Guiding: 02

International/National Publications:

1. Sunil K S Venkatesswaran G and **D Gayathri** (2018) Screening of potential of Lactobacillus strains isolated using home made curd from Mysore district, Karnataka *EC Microbiology* 14(7):361-383.

2. Devaraja Gayathri and Vasudha M (2018) Lactose Intolerance with Special Emphasis on Probiotics for Management. 13(5):325-332.
3. Rashmi BS and **Gayathri D** (2017) Draft genome sequence of gluten ydrolysing bacterium *Bacillus subtilis* GS 188. *GenomeA, (American society of Microbiology)* DOI:10.1128/genomeA.00952-17
4. Rashmi BS and **Gayathri D** (2017) Molecular characterization of gluten hydrolyzing *Bacilllus* sp. And their efficacy and biotherapeutic potential as probiotics using Caco-2 cell line. *J Appl Microbiol (Wiley online),* 123(3) DOI: 10.1111/jam.13517. *IF;2.1*
5. Rashmi BS and **Gayathri D** (2017) Evaluation and Optimization of Extracellular Digestive Enzymes from Bacillus spp. Isolated from Curds. *Matern Pediatr Nutr*, 3:1 DOI: 10.4172/2472-1182.1000118
6. Somaraja PK and **Gayathri D** (2016) Biodegradation study of a novel Biphenyl degrading bacterial isolate GS-008. *Ind J Sci Tech.* 9(S1), *DOI: 10.17485/ijst/2016/v9iS1/109813,*
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8. **Devaraja Gayathri** and Jayanna K Shobha (2016) Bioremediation of 2,4 dichlorobiphenyl (Ortho chlorinated) by the consortium of Pseudomonas isolates GSa and GSb - A lab scale study. *Int J Adv Lif Sci* 9(4):438-444. ISSN 2277–758X
9. Swamy CT, **Devaraja Gayathri,** Devaraja TN (2016) Antibacterial activity of lichens *Parmotrema tinctorum* and *Pyxine sorediata* and their secondary metabolites. *Int J Adv Lif Sci.* 9(3):373-380. Online ISSN:2277-758X. Print ISSN:2320-1827.
10. **Devaraja Gayathri** and Rashmi BS (2016) **Anti-Cancer Properties of Probiotics; A Natural Strategy for Cancer Prevention and Management.** *EC Nutrition* 5(4): 1191-1202.
11. Shobha K Jayanna, **Devaraja Gayathri**, Somaraja Palegar Krishnappa (2016) Diversity of 2, 4 Dichlorobiphenyl degrading consortium of *Pseudomonas* isolates GSa and GSb for degradation of Poly Chlorinated Biphenyl

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12. **Gayathri Devaraja**, Bhavyashree G and Rashmi BS (2016) Food Allergy: Immunological Mechanisms and Prevention Strategies. *EC Nutrition.* 5(1): 1058-66
13. Gayathri D and Rashmi BS (2016) Critical analysis of wheat as food. *J Matern Pediatr Nutr*. 2:3. DOI:10.4172/2472-1182.1000115
14. Gayathri D and Rashmi BS (2016) Microbial Diversity in Different Organs of Human System. *J Food Microbiol.* 1(1). DOI: http://dx.doi.org/10.20936/JFM/160101
15. **Gayathri D** (2016). Short note on Probiotics for Mental health and Anxiety. *J Matern Pediatr Nutr* 2: 114. doi:10.4172/mpn.1000114
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17. **Gayathri D** (2016) Probiotics for total health: Better today and tomorrow. *J Matern Pediatr Nutr* 2(1) http://dx.doi.org/10.4172/mpn.1000107
18. Shobha K Jayanna and **Devaraja Gayathri** (2015) Degradation of 2,4 dichlorobiphenyl via metacleavage pathway by *Pseudomonas* spp. Consortium. *Curr Microbiol* 70(6):871-876. DOI: 10.1007/s00284-015-0800-3 IF:1.519 (Springer)
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21. Shobha K Jayanna and **Devaraja Gayathri** (2014) Optimization of 2,4 dichlorobiphenyl (PCB Congener) degradation by *Pseudomonas spp*. *Bulletin of Environ and Scientific Res*.3(2-3) 1-7.
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32. **Gayathri D** and Swamy CT (2012) Lichens: A novel and potential source of antimicrobials for human use. *J of Phytology,* 4(1): 38-43. ISSN: 2075-6240
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35. **Gayathri D**, Asha and T. N. Devaraja (2011) Lactobacillus sp. as probiotics for human health with special emphasis on colorectal cancer. *I. J of Sci and Tech*. 4 (8) 1008-1014. *ISSN*: 0974-6846 EISSN: 0974-5645 **DOI**: 10.17485/ijst/2011/v4i8/30912
36. **Gayathri Devaraja**, KM. Shankar, CV Mohan, TN Devaraja, TM Anil, P Keshavanath (2008) Antigen characterization and epitope analysis of *Aphanomyces invadans* of epizootic ulcerative syndrome pathogen by monoclonal antibodies. *J. Asian fisheries sci* 21(2) 215-227. ISSN : 0116-6514
37. **Gayathri D**, Shankar K M, Mohan C V (2008) Determination of specific sampling site on EUS affected fish for diagnosis of *Aphanomyces invadans* by immunodot using monoclonal antibodies. *Research J of Agri and Biolog Sci,* 4(6). 757-760. ISSN 1816-1561
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40. Devaraja TN and **Gayathri D** (2004). Organic wastes and bioremediation in relation to water quality management in aquaculture. *Fishing Chimes* 24(4) 27-30.*ISSN*, 0971-4529

Chapters in Books:

- Gayathri D. and Devaraja TN. (2003) Hybridoma technology in aquaculture health management with an emphasis on *Aphanomyces invadans* of epizootic ulcerative syndrome in fish. In: Biotechnology in Environmental Management, ed. T

Chakrabarti, T K Ghosh, G.Tripathi. APH Publishers, New Delhi, p. 361-373.

- Devaraja TN and Gayathri D. (2003). A review on microbial products for disease management and improved production in aquaculture. In: Biotechnology in environmental management, ed T Chakrabarti, T K Ghosh, G Tripathi. APH Publishers, New Delhi, p. 325-337.
- Gayathri Devaraja and Devaraja TN (2012). Antigen: specificities and types. In: *Cellular and Biochemical Science*, Ed. G Tripathi. I K International Publishers, New Delhi.p.537-548.
- Gayathri Devaraja and Devaraja TN (2012). Hybridoma Technology: Applications of monoclonal antibody. In: *Cellular and Biochemical Science*, Ed. G Tripathi, I K International Publishers, New Delhi.p.580-587.
- Gayathri D & BS Rashmi (2018) Diversity of Microorganisms in Human System. In:Biodiversity conservation (Applications and implications, Ed. BB Hosetti & Bharathi, Write and Print publications, New Delhi. p 33-41

E Chapter: Rashmi BS and **Gayathri D** (2017) Celiac Disease - A Chronic Enteropathy, Its Management with an Emphasis on Probiotics. http://openaccessebooks.com/probiotics-chronic-diseases-prevention.html

Paper Published at Technical record: Gayathri Devaraja (2013) Effect of pomgamia cake on beneficial soil microorganisms in areca plantation. KSCST:SPP: Biofuel projects compendium, 2012-13 page no.65-66

Popular articles,

1. Gayathri Devaraja (2018) Cancer roogada virudda horadalu nisargadatta jeeva samrakshaka sookshmanu jeevigalu (probiotics) *Vijnana Loka*, KASTA, Govt of Karnataka, 11(6):31-32
2. Gayathri Devaraja (2017) Vaijnanika samshodhane matthu Samshodhaka. *Vijnana Loka*, KASTA, Govt of Karnataka, 10(6) 20-21.
3. Gayathri D, Swamy CT, Devaraja TN and Sanjeeva Nayaka (2016) Kallu hoovugala samshodhana lokadallondu inuku nota. *Vijnana Loka*, KASTA, Govt of Karnataka, 10(1), Decennial Edition, 33-36
4. Gayathri Devaraja (2016) Ahaara matthou Arogyavardhane: Japaneyara Arogyada guttu, *Janatavani Daily*, 25th March, 2016, 42(312):3
5. Gayathri Devaraja (2015) Janma janmada anubandha ee sookshmanu jeevigala sambhanda, *Janatavani Daily*, 18th Nov 2015.184(184):3
6. Gayathri Devaraja and Swamy CT (2015) Refrigerator, ahaara surakshathe matthu namma nambike, *Janatavani Daily*, 5th August 7, 2015, 42(83):4.
7. Gayathri Devaraja (2014) Sookshmanujeevigalu matthu Navu, *Janatavani daily*, 11th June 2014, 41(28); 4.
8. Gayathri D, Swamy CT, Devaraja TN and Sanjeeva Nayaka (2014) Kallu

hoovu: Deha ondu, Jeeva yeradu.Feb 2014, *Hosatu*, *(monthly magazine)* Navakarnataka Publications. Bangalore, Karnataka. 15(7):43-46.

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12. Devaraja TN and Gayathri Devaraja (2006). Krishi pooraka – Kolagalalli meenu krishi. *Sujatha Sanchike*, October '06, 12-14.
13. Devaraja TN, Gayathri Devaraja and Mamatha HR (2006) Krishi badukinalli susthirathe yemba neralu belakina hoydata. *Janatha Vani (daily)* Sapthahika sanchaya, 8 October '06, 3-4.
14. Gayathri S (2001) AIDS, Arivu matthu Hone, *Savitha Vani* (Kannada monthly magazine), South Canara, March 2001, 7(5): 7-10.

Radio Talks:

- Yuva vani, "Importance of probiotics" AIR, Chitradurga. Broadcasted on 28/7/2017
- Interview in Krish Ranga on 'Importance of microorganisms in agriculture', AIR, Chitradurga. Broadcasted on 16/9/2014
- Interview in Yuvataranga on Educational & Employment opportunities for Microbiology Graduates. AIR, Chitradurga. Broadcasted on 4/7/2012.
- Farmer's friendly and Rapid detection test for EUS. Krishi Ranga, AIR, Bhadravathi, broadcasted on 10/1/2011.
- Job opportunities and Scope of Microbiology in Research for youth. YuvaVani, AIR, Bhadravathi, broadcasted on 17/7/2008.

Conference paper presentations & Posters:

1. Vasudha M and Devaraja Gayathri (2018) Indigenous lactic acid bacteria to overcome lactose intolerance: A preliminary study. *In:*National conference on :Science & Technology for inclusive development, organized by KSTA and Gulbarga University, India, on 6-7 March 2018. p 19-20.
2. Vasudha M and Devaraja Gayathri (2018) Antibacterial effect of indigenous lactic acid bacteria for lactose intolerance isolated from curd samples. *In:*National conference on :Current microbial challenges in the environment, organized by the DEPT OF Microbiology, Kuvempu University, India, on 9-10 March 2018. p 50-51.
3. Swamy CT and D Gayathri (2016) Molecular characterization and plant growth potential of Lichenized bacteria from crustose lichens from Chitradurga fort. *In:*International symposium on "Understanding the molecules of life in the era of New Biology, organised by the Depts of Life sciences. Davangere University. India, on 20-22 October 2016. p 99-100.
4. Rashmi BS and D Gayathri (2016) Molecular characterization of gluten hydrolyzing *Bacillius* sp and evaluation of probiotic potential in Caco-2 celllines. *In:* International conference on Science and technology: Future challenges and solutions, Organised by JSPS and University of Mysore.

August 8-9, 2016. Held at University of Mysore. P.135.

5. Swamy CT and D Gayathri (2016) Molecular characterization and plant growth potential of Lichenized bacteria from crustose lichens of stone fort Chitradurga, Karnataka, India. *In:* International conference on Science and technology: Future challenges and solutions, Organised by JSPS and University of Mysore. August 8-9, 2016. Held at University of Mysore. p.164.
6. Sunil Kumara S, D Gayathri, G. Venkateswaran, P Hariprasad and Ambika Vasist (2016) Evaluation of *Lactobacillus* spp isolated from curd for aflatoxin B1 binding properties. *In:* International conference on Science and technology: Future challenges and solutions, Organised by JSPS and University of Mysore. August 8-9, 2016. Held at University of Mysore. P. 148.
7. Swamy CT and D Gayathri (2015) Antibacterial activity of different solvent extracts of Lichen, *Parmotrema tinctorum* and *Pyxine sorediata*. *In:* 11th Karnataka Science Congress, Organised by Swadeshi vijnana andolana-Karnataka. September 13-15, 2015. Held at Laxmi Venkatesh Desai College, Raichur. p. 154
8. Rashmi BS and D Gayathri (2015) Screening and characterisation of probiotic indigenous gluten degrading bacteria- An attempt for preliminary development of gluten reduced food for celiac disease patients. *In:* NABS National Seminar on 'Biological products for crop, animal and human health-problems and prospects'. Organised by the Dept of Biotechnology, University of Mysore and National Academy of Biological Sciences, Chennai, August 21-22, 2015. p 71
9. Somaraja PK and Gayathri D (2015) A novel *Stenotrophomonas maltophilia* degradaing 2 chlorobiphenyl. *In:*International conference on 'Bioactive chemicals for reproduction and human health' organised by the Depts of Life sciences. Davangere University. India, on 26-28 Feb 2015. p 79.
10. Shobha KJ, Gayathri D and Somaraja PK (2015) Comparative study of *Pseudomonas* sp GSa and GSb for biodegradation of 2,4 dichlorobiphenyl. *In:*International conference on 'Bioactive chemicals for reproduction and human health' organised by the Depts of Life sciences. Davangere University. India, on 26-28 Feb 2015. p 80.
11. National Seminar: Gayathri D and Shobha KJ (2013) Biodegradation of Methoxychlor derivative, 2, 2 dichloro 4 methoxyphenyl by Bacillus sp. *In;* National seminar on 'Trends in environmental Biotechnology and its applications', organized by Dept of Biotechnology and Botany. St Aloysius College, Mangalore, India, on 10-11 Dec 2013. p 52.
12. National Seminar: Rashmi BS and Gayathri D (2013) Optimisation and probiotic potential of Lipase producing Lactobacillus sp G5, isolated from goat curd of migrant Shepherd population of North Karnataka region, India. *In;* National seminar on 'Trends in environmental Biotechnology and its applications', organized by Dept of Biotechnology and Botany. St Aloysius College, Mangalore, India, on 10-11 Dec 2013. p 49.
13. National Seminar: Swamy CT, Gayathri D and Devaraja TN (2013) Diversity of Lichen species in Chitadurga Fort region, Karnataka, India *In;* National seminar on 'Trends in environmental Biotechnology and its applications', organized by Dept of Biotechnology and Botany. St Aloysius College, Mangalore, India, on 10-11 Dec 2013.
14. Seminar and Exhibition: Gayathri D and Shivali JD (2013) Effect of Pongamia cake on

beneficial soil microorganisms in areca plantation. *In*: 36th series, 2012-13 Biofuel Projects selected for seminar and exhibition held at Angadi Institute of Technology and Management, Belgaum, on 30-31 August 2013, In Biofuel Technical Record: 2012-13, p 65-66.

15. National conference: Somaraja PK and Gayathri D (2012) PCB degrading potential of aerobic bacteria from oil contaminated soil. *In:* National conference on environmental sciences and health hazards & XIV annual meeting of society for science and environment, Dept of Biotechnology and Microbiology, Karnatak University, Dharwad, India, 19-21 Nov 2012, p 7
16. National conference: Somaraja PK, Gayathri D, Eramma N (2012) Evaluation of potential of *Flucortia indica* against some human pathogenic bacteria. *In*: UGC sponsored national conference on "Biotechnological prospecting in herbal antiviral and anticancerous drug development", Sri Dharmastala Manjunatheswara College (Automonous), Ujire. Feb 17-18, 2012, p52-53.
17. National symposium: Chaired session: Renewable energy and sustainable development (UGC innovative program), Dept of Social Work, Davangere University, 19-20 March 2012.
18. Special Lecture: Gayathri D (2011) Role of environmental Biotechnology in sustainable development. Two days national symposium on 'Governance, social justice and sustainable development', 30-31 March 2011. Dept. Of Social Work. Davanagere University. Davanagere, India.
19. Indo-US work shop: On Global intracellular pathogens. Jawaharlal Nehru University, New Delhi. 30 Jan-5 Feb 2011.
20. Conference: Gayathri D, Somaraja PK, and Shobha K J (2010) Indigenous bacteria for bioremediation of Polychlorinated biphenyls from industrial effluents. 16th National conference and symposium on 'Applications of Biotechnology in environment management and medicine, 19-21 Nov. 2010. Bapuji institute of Engineerinng and technology, Davanagere, India.
21. Conference: Gayathri D, Somaraja PK, and Shobha KJ (2010) Microbiological degradation of Polychlorinated biphenyls. 8-10 Nov. Women's Science Congress, Davanagere University, Davanagere.
22. Conference: Gayathri Devaraja and Asha (2010) Synergestic effect of *Lactobacillus* sp and *Catheranthus roseus* for potential intenstinal pathogens. 8-10 Nov. Women's Science Congress, Davanagere University, Davanagere.
23. International Symposium – Asha and Gayathri Devaraja (2010) Microbial interration study of *Lactobacillus* sp, against infectious intestinal pathogens. 11th Sir Dorabji Tata Symposium on 'Diagnostics in infections', Indian Institute of Science, Bangalore. 10-11 March 2010 p. 48
24. National conference – Shivakumar PS and Gayathri Devaraja (2008) Isolation and evaluation of Nitrogen waste degrading bacteria from domestic sewage. 24th National conference of ISCAP on 'Biotechnological strategies for biodiversity conservation, 13-15 March 2008 p. 13.
25. National conference- Bhargavi Prabhuswamy, Gayathri Devaraja and Sanjay KN (2008) A study on distribution of human blood group antigen in and around Shivamogga dist. 24th National conference of ISCAP on ' Biotechnological strategies for biodiversity conservation', 13-15 March 2008 p. 124-125.
26. International Conference Paper: Shankar KM, Mohan CV and Gayathri S (2002)

Monoclonal antibodies for antigen characterization and detection of *Aphanomyces invadans* – causative agent of EUS. The sixth Indian Fisheries forum, Asian fisheries society, Indian branch, Mumbai.17-20 December, 2002. P. 146.

27. International conference (Poster): Gayathri Devaraja and Shankar KM (2005) A novel method of detection of fungal pathogen *Aphanomyces invadans* having zoonotic potential by IgG1 monoclonal antibody. Indo-Australian conference on "Biotechnology of Infectious Diseases", Kasturba Medical College, Manipal. 1-3 March, 2005 p.99.
28. National conference (Poster): Gayathri Devaraja and Shankar KM (2003) Field application of monoclonal antibodies for the detection of *Aphanomyces invadans*, the causative agent of EUS in fish.. 44th All India Microbiologists Conference, UAS, Dharwad. 12-14 November 2003 p 95-96.
29. Conference paper: Gayathri Devaraja, Shankar KM and Devaraja TN 2007) A molecular tool for the detection of *Aphanomyces invadans* in culture Ponds. 3rd Kannada Science conference, SVAK, Kuvempu University 15-17 sept 2007. p 73-74.
30. Conference paper: Devaraja TN and Gayathri Devaraja (2007) Scientific integrated fish farming- a boon to small farmers. 3rd Kannada Science conference, SVAK, Kuvempu University 15-17 sept. 2007.p 72-73.
31. Special Lecture: Ozone depletion: Health effects. 15 September 2008. Economics Forum, Dept. of Economics, P G Centre, Davanagere.

Reviewer for National/International Journals: *J applied Microbiology (Wiley), Scientific Reporter, Bulletin of Environmental contamination & Toxicology (springer), Microbiology & Immunology (Wliey Blackwel online Library), Indian J of Science and Technology, Avicenna J of Microbiology & Biotechnology.ScienceAsia (Bankok),Phillipine Agricultural scientist (Philippines), Microbial cell factories (BioMed Central, USA), Bioanalysis and Biomedicine (UK),Brazilian J Archives of Biology (Brazil), Hyati J of Microbiology (Elsevier), Jundishapur J Microbiology,J Food safety (Wiley online), Soil and Sediment contamination (Taylor & Francis), J Environmental Biology. Indian J of experimental biology, J cereal science*

Editorial Member: Journal of Maternal and Paediatric Nutrition.

Journal of Food Microbiology

Special participation

1) Coordinator:'Youth Parliament session and won First proze at National Level: III National Inter University Youth parliament competition, year 199-2000. Organised by Ministry of Parliamentary Affairs, Govt of India.
2) Participated at National level Orientation program on youth parliament program, held at Madurai Kamaraj University, Madurai, TN. 11-13 Sept 2001.

Orientation / Refresher Courses

- UGC sponsored Orientation Course, October 30-November 25, 2000, Manasa Gangothri, Mysore. Karnataka.
- UGC sponsored Refresher Course, October 9-30, 2003, Kuvempu University, Shankaraghatta, Shimoga. Karnataka.

Research Interests

1. Bioremediation for sustainable environment
2. Use of monoclonal antibodies for detection of animal and human pathogens
3. Probiotics for healthcare.
4. Conjugated/multi-targeted Vaccine development for pathogenic bacteria using hybridoma and nano technology.

Computer Knowledge:

- Diploma in Computer Applications at Bharathiya Vidya Bhavan, Mangalore (6 months, 1999), Working knowledge of MS Windows, Word, Excel, Power Point.

Awards/Recognitions:

- **Three stars Merit certificate**: By Ministry of Education and Culture, Govt of India. (1987)
- **Best AMI research paper award- 2003** for "Field application of monoclonal antibodies for the detection of *Aphanomyces invadans*, the causative agent of EUS in fish". **Best AMI (poster) paper award- 2003**
- **State award: State Sadbhavana Award** (Best researcher) by Human rights commission (Bangalore, India)- **2011**
- **Overseas fellowship:** International training course on vaccinology, International Vaccine Institute, Seoul, S. Korea. 14-19 May 2012.
- **Project of the year:** Karnataka State Council for Science and Technology, IISc, Bangalore, SPP 36th series awarded **Outstanding Project** during Seminar and Exhibition held at Angadi Institute of Technology and Management, Belgaum on 30-31 August 2013. And also awarded the cash prize.
- **Project Monitoring Committee Member**: Ministry of Environmental, Forestry and climate change, Govt. of India. New Delhi.

Special lectures delivered:30