

एन बी आर आई

समाचार पत्रिका

A View of Fern House

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1. RESEARCH ROUND-UP

BIOLOGICAL AND MOLECULAR CHARACTERIZATION OF TOMATO ASPERMY VIRUS STRAINS INFECTING CHRYSANTHEMUMS IN INDIA

A. BIOLOGICAL AND SEROLOGICAL CHARACTERIZATION

1. Natural symptoms of tomato aspermy virus : Leaf samples of chrysanthemums were collected from nurseries at fifteen locations in India : Kolkata (West Bengal); Dhanbad (Jharkhand); Patna (Bihar); Jammu, Katra (J & K); Baijnath Dham, Chintpurna Devi (HP); Chandigarh; New Delhi; Lakhimpur, Lucknow, Kanpur (UP); Hyderabad (AP); Mysore (Karnataka) and Ooty (TN) and infection of Tomato Aspermy Virus (TAV) was suspected (Fig. 1). Naturally infected chrysanthemum plants exhibit various symptoms : yellow mosaic, marginal yellowing, vein yellowing, vein banding on leaves, stunting of whole plant and flower deformations (Fig. 2-4).

2. Experimental transmission of tomato aspermy virus : The transmission of these isolates was attempted by mechanical inoculation on various host plants *viz.* *Chenopodium amaranticolor*, *C. quinoa*, *Nicotiana tabacum* cv. Petit Havana (NTPH), *N. tabacum* cv. White Burley, *N. rustica*, *Datura metel*, *Lycopersicon esculentum* and *Cucumis sativus*. The virus isolates could be transmitted by mechanical inoculations to most of the test plants which developed local chlorotic/ necrotic lesions and or systemic mosaic symptoms. The virus was also

transmitted successfully from chrysanthemum to tomato by aphids (*Aphis gossypii*) which caused mosaic and seedless fruits.

3. Serological detection of chrysanthemum aspermy virus : Initial detection of TAV was done by direct antigen coating enzyme-linked immunosorbent assay (DAC-ELISA). The DAC-ELISA was performed using TAV specific antibodies (PVAS24) and sap of infected plants was used as antigen. Total 18 samples collected from various locations and one healthy symptomless chrysanthemum (as negative control) were screened. During DAC-ELISA the maximum mean absorbance value was observed as 0.916, 0.801, 0.620 and 0.323 in naturally infected chrysanthemum samples collected from Lucknow, Kolkata, Katra and Dhanbad, respectively, as compared to 0.043 in case of the negative control (healthy chrysanthemum) plant. However, TAV infection was detected from 15 out of 18 samples collected from various locations (Table-1) which indicate the distribution of TAV in India (Fig. 1).

B. MOLECULAR CHARACTERIZATION OF TAV ISOLATES

1. Detection of TAV by reverse transcription-polymerase chain reaction : For molecular detection of the virus, total RNA from 100 mg leaf tissue of infected chrysanthemum plants collected from various locations, was extracted following the procedure of Pawlowski *et al.* 1994 and reverse transcription was done in a mixture containing 1 μ g of RNA template, 25 pM of TAV-CP gene specific





Fig 1. Infected samples of chrysanthemum collected from different locations in India and distribution of TAV infection in India as evidenced by ELISA and RT-PCR tests. Red stars showing positive infection of TAV

reverse primer and nuclease-free water. Further PCR was carried out in a 50 µl reaction mixture containing 10 ng c-DNA as template, 1X Pfu Taq Polymerase buffer, 200 µM dNTPs, 25 pM forward and reverse primers and 3 U Pfu-DNA Polymerase (MBI Fermentas, Life Sciences, USA). The PCR cycles were : denaturation at 94°C for 5 min followed by 30 cycles of 94°C for 1 min (denaturation), 58°C for 45 sec (annealing) and 72°C for 45 sec (extension), then a 7 min final extension at 72°C.

PCR products were electrophoresed in 1% agarose gel with DNA marker (Lambda DNA *EcoR* I/ *Hind* III, Bangalore Genei Pvt. Ltd, India). The expected size ~650 bp band was successfully amplified from most of the chrysanthemum samples collected from various locations. The total 5 out of 7



Fig 2. Floral deformations in large bloom varieties of chrysanthemum



Fig 3. Floral deformations in large bloom varieties of chrysanthemum as compared to healthy (right)



Fig 4. Ring spots, and yellow spots, yellowing and greening of veins on chrysanthemum leaves

samples tested showed RT-PCR positive amplification as compared to negative control (Table-1).

2. Cloning and sequencing of complete RNA 3 genome of TAV :

For cloning of complete RNA 3 genome of TAV, the primers were designed and used for amplification of complete RNA 3 genome. The RT-PCR was standardized with different annealing temperatures with a continuous increase of 2°C (from 56 to 66°C) using the primers designed for amplification of full length RNA 3 genome of Kolkata, Dhanbad and Lucknow-TAV isolates. The expected size (~2.4 kb) amplicons were obtained at all the temperatures but the amplicon intensity and quality as single band was obtained at 66°C. The full length amplicon was purified and cloned in a suitable cloning vector (Fig. 5). Three clones of each strain were sequenced and analyzed for their identities.

3. Sequence analysis of TAV isolates at complete RNA 3 level :

The sequence, obtained from the three clones, was assembled and analyzed for the consensus sequence in its entirety with no

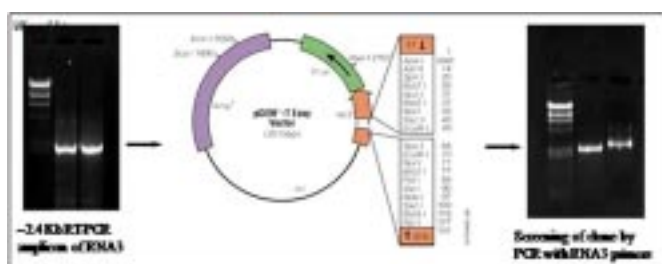


Fig 5. Cloning strategy of RNA 3 genome of *Tomato aspermy virus* in a suitable vector

ambiguities remaining. Data analyses of RNA 3 genomes of Kolkata, Dhanbad and Lucknow-TAV isolates revealed that complete length of RNA 3 is 2386 nucleotide and consisted of two ORFs. The first in frame ATG(AUG) (start codon) in the ORF was at position 192-194 nt and had termination-TAG(UAG)-codon at 930-932 nt position and identified as MP gene of 741 nt translating 246 aa. The second ORF started (ATG/AUG) at position 1228-1230 nt and terminated (TAG/UAG) at 1882-1884, and identified as CP gene of 637 nt translating 218 aa. MP and CP ORFs were separated by 295 nt long intergenic region and flanked by 5' un-translated

region (UTR) and 3'UTR of 191 and 502 nt, respectively (Fig. 6). Consensus sequence of the virus isolates was determined and complete RNA 3 sequence was deposited in NCBI GenBank under the accession EF153735 (Kolkata), EU163410 (Dhanbad) and EU163411 (Lucknow).

BLAST analyses of complete RNA 3 gene of Lucknow-TAV isolate revealed highest 99% nucleotide identity with Kolkata, V and Dhanbad strains of TAV while 98% identity was obtained with

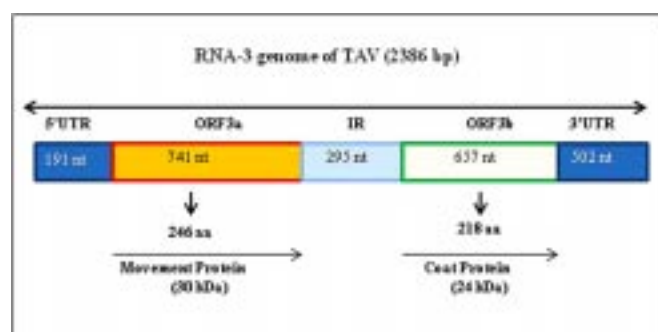


Fig 6. RNA 3 genome of *Tomato aspermy virus* showing its details: ORFs and non coding regions

Table-1. Detection of *Tomato aspermy virus* (TAV) by DAC-ELISA and RT-PCR in *Chrysanthemum* samples collected from different locations

S. No.	Symptoms	Place	OD* at 405nm with TAV antiserum (PVAS 24)	RT-PCR with TAV-CP primer
1	Marginal necrosis	Bajjnath Dham (H P)	0.039	-
2	Mild mosaic	Chintpurna Devi (H P)	0.212	Not checked
3	Severe marginal yellowing	Katra (J&K)	0.620	Not checked
4	Vein banding	Jammu (J&K)	0.147	++
5	Severe yellow mosaic	Jammu (J&K)	0.527	Not checked
6	Ring spots	Chandigarh	0.198	+
7	Vein clearing	New Delhi	0.053	+
8	Severe vein yellowing	Lucknow (UP)	0.916	++++
9	Yellow veins	Lucknow (UP)	0.222	Not checked
10	Green veins	Lucknow (UP)	0.127	+
11	Green veins	Lakhimpur (UP)	0.213	Not checked
12	Yellow veins	Kanpur (UP)	0.122	+
13	Severe marginal chlorosis	Patna (Bihar)	0.219	+
14	Chlorotic rings	Dhanbad (Jharkhand)	0.323	+++
15	Flower deformation	Kolkata (WB)	0.801	++++
16	Mild mosaic	Mysore (Karnataka)	0.246	Not checked
17	Mild chlorosis	Ootty (TN)	0.125	++
18	Mild vein banding	Hyderabad (AP)	0.042	-
19	Healthy symptomless	Lucknow (UP)	0.043	-

*OD > 0.200 considered as positive infection (bold). + = positive amplification (number of + indicates intensity of band) and - = no amplification by RT-PCR with TAV specific primers

KC, C and B strains, whereas minimum 97% was with I-TAV and P-TAV (Table-2).

Multiple sequence alignment of complete RNA 3 components of TAV isolate of Lucknow with the selected TAV strains revealed that Lucknow isolate shared common features, viz. conserved TG tract in 5'UTR, size of CP (657 nt) equal to all TAV strains, except B-TAV (654 nt, Acc S72468) and C-TAV (690 nt, Acc D01015), presence of the motif 'GTTCAATTCC' and ICR-2 like conserved motif and a highly conserved region of 40 nucleotides 'G A A C G G G T T G T C C A T C C A G C T A A C G G C T A A A T G G T C A G T' at 3'UTR, the unique features found in all cucumoviruses sequenced to date. Around 116 additional nucleotides were present only in I-TAV isolate (reported from USA). The Lucknow virus isolate under study also contained 15 unique nucleotide substitutions: 94 (T/C), 107 (C/A), 117 (T/C), 275 (T/C), 293 (A/G), 309 (C/G), 659 (C/T), 1335 (T/G), 1373 (A/G), 1386 (C/T), 1496 (C/T),

1689 (A/G), 1800 (T/C), 2243 (A/G) and 2327 (C/T). CP gene based multiple amino acid sequence alignment of TAV Lucknow, Dhanbad, Kolkata isolates with the available CP amino acid sequence of Indian isolate revealed high similarities. N-terminal span of CP was found more homologous than C-terminal. Thirty-eight amino acid residues (from position 51-89) of CP at N-terminal region were found most conserved in all TAV sequences reported till date.

Complete RNA 3 component of virus isolates shared 99-98% nucleotide identities among themselves (Lucknow, Kolkata and Dhanbad) and with V, KC, C, P, I and B strains of TAV reported from other parts of the world, when analyzed by multiple sequence alignment (Table-2).

The minimum 48 and 42% identities were obtained with Peanut stunt virus (Acc AY775057) and *Cucumber mosaic virus* (EF153734), members of genus *Cucumovirus* used for reference as out-group.

Table-2. Percent nucleotide (nt) and amino acid (aa) identities of three Indian strains: Kolkata (K-TAV, Acc. EF153735*), Dhanbad (D-TAV, Acc. EU163410*) and Lucknow-TAV (L-TAV, Acc. EU163411*) with worldwide known TAV strains and members of genus *Cucumovirus* based on NCBI-BLAST search analysis

Accession	Location/ Country	Abb.	% identity at level of								
			RNA3 nt	5'UTR nt	MP nt	aa	IR nt	CP nt	aa	3'UTR nt	
EU163410	Dhanbad, India	Dha-TAV ^a	9 8	97	99	99	100	96	96	99	
EU163411	Lucknow, India	Luc-TAV ^a	9 9	100	99	99	100	97	99	100	
AJ586134	HP, India	HP-TAV ^a	-	-	-	-	-	96	97	-	
AJ550020	Punjab, India	PU-TAV ^a	-	-	-	-	-	96	96	-	
L79972	Spain	V-TAV	9 9	97	99	100	100	99	100	99	
<u>AJ277268</u>	Australia	V-TAV	9 9	100	99	100	100	99	100	99	
<u>L15335</u>	Hungary	P-TAV	9 8	98	99	100	98	99	100	98	
<u>AJ237849</u>	Korea	KC-TAV	9 8	97	99	100	99	98	100	98	
<u>AJ277269</u>	USA	I-TAV	9 8	94	99	99	98	98	100	96	
<u>S72468</u>	Blencowe	B-TAV	9 8	100	97	95	98	98	100	94	
<u>D01015</u>	England	C-TAV	9 8	100	95	89	99	98	97	98	
<u>AY775057</u>	<u>China</u>	PSV	4 8	36	68	76	43	60	70	51	
<u>EF153734</u>	<u>India</u>	CMV	4 2	45	52	63	46	37	41	48	

CP gene based analysis of Lucknow, Kolkata and Dhanbad isolates showed highest 96-99% nucleotide identity, whereas the amino acid identities were 96-100% (Table-2). Maximum 89% nucleotide identities were recorded with the V and KC strains of TAV. However, highest 95 amino acid identities were obtained with V and KC strains of TAV. The identities of other gene as MP gene, 5'UTR, 3'UTR and intergenic regions at nt level were 95-99%, 98-99%, 94-100%, 94-99% and 98-100%, respectively with selected strains of TAV considered for the study (Table-2).

4. Phylogenetic relationships of TAV isolates at RNA 3 level : All TAV strains with their complete RNA 3 genes, existed in GenBank database were selected for phylogenetic analysis and CMV (EF153734) and PSV (AY775057) strains were considered as a source of reference sequence for out group and rooting of dendrogram. Phylogenetic analysis of complete RNA 3 component of TAV isolates resulted into non-congruent dendrogram. Among Indian strains, Kolkata and Lucknow clustered together, whereas Dhanbad isolate clustered discretely. However, all the three isolates showed close relationship with KC strain, whereas distant relationships were observed with C, P, I, V and B-TAV strains (Fig. 7).

Spanish and Australian V-TAV strains fall in one cluster, whereas I, P, B and C-TAV strains clustered together. Phylogenetic analysis indicated that Indian isolates have some unique genetic features, which lead them to clade distinctly. PSV strain was found closer to TAV strains as compared to CMV.

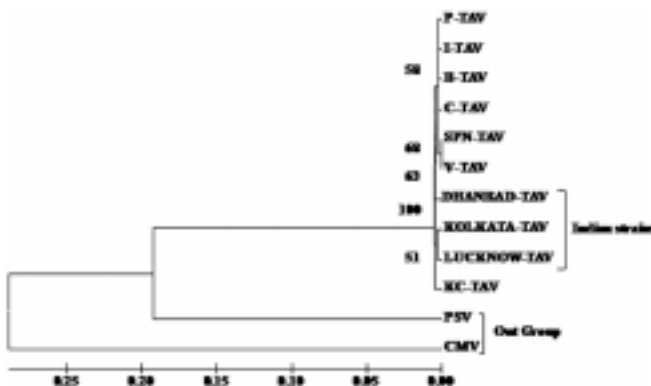


Fig 7. Phylogenetic tree showing relationships of Indian strains of *Tomato aspermy virus* (under study) with other strains of TAV reported worldwide

5. Recombination analysis in genome of TAV isolates : During phylogenetic analysis, Kolkata and Lucknow isolates also clustered with other Indian isolates available in GenBank database, while Dhanbad isolate showed diverse behaviour and clustered with SPN-TAV strain (Acc L79972). To find the putative cause of this diverge behaviour of Dhanbad isolate, recombination analysis was also carried out with Recombination detection program (RDP) v1.08 using GENECONV method (Padidam *et al.*, 1999).

The analysis showed maximum (seven) recombination events in CP gene of Dhanbad isolate that could explain its divergent behaviour. Two recombination events were also observed in Lucknow isolate, with rest two Indian strains under study as well as other TAV strains reported from abroad (Fig. 8). Kolkata isolate did not show any recombination events. The result obtained revealed that this recombination is the cause of this diverge behaviour of Dhanbad isolate.

Biological assay with Dhanbad isolate also indicated clear cut differentiation between Dhanbad isolate and other two Indian strains under study, supporting the recombination in CP region of Dhanbad isolate.

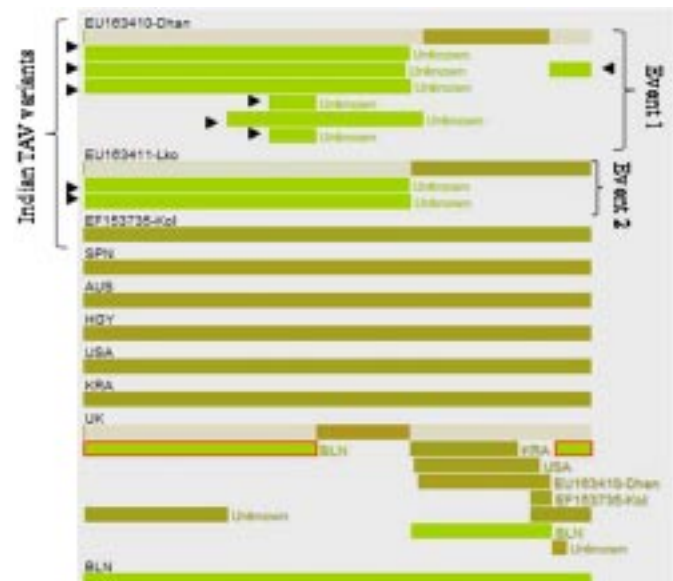


Fig 8. Analysis of recombination events using RDPV showing two independent events in Indian strains of TAV as compared with other TAV strains reported worldwide as identified by GENECONV method

NEW CULTIVARS DEVELOPED

1. GLADIOLUS 'ROSHNI'

Parents : 'Friendship Pink' (Female) x 'Red Beauty' (Male)

Description : A hybrid seedling; plant height 0.95-1.0 m; spike length 0.70-0.75 m; no. of florets per spike 12-15; size of floret 9-10 x 8-9 cm across; all petals having similar base colour - pinkish-red (Red Group 52B, Fan-1) while streaks of orange-white originate from throat to periphery. Each petal has a central nerve of orange-white (Orange-white Group 159D, Fan-4) from base to tip. Back of the floret is having more prominent streaks of orange-white on base colour of pinkish-red.



Speciality : Name of the cultivar is after the attractive, soft but bright flower colour which creates sparkle. Medium spike length and comparatively small-sized flowers are suitable for making modern presentation bouquets. (Breeder : Dr. RK Roy)

2. GLADIOLUS 'JAMUNI' ('AMETHYST')

Parents : 'Lavender Puff' (Female) x 'Tropic Sea' (Male)

Description : A hybrid seedling; plant height 1.15-1.20 m; spike length 0.90-0.95 m; no. of florets per spike 16-18; size of the floret 11-12 x 10-11 cm across; bi-coloured in combination of purple and yellow-white (Purple Group 77B, Fan-2; Yellow-white Group 158C, Fan-4). Outer four petals slightly frilled, tip pointed and curved outward, having 80% purple colour and rest is yellow-white. Inner two petals are obtuse, having 20% purple



MoUs SIGNED

Sl. No.	Details	Client	Date
1.	Providing technical services for documentation and advice for calibration of equipment and glassware	Mahatma Gandhi Institute for Rural Industrialization, Wardha (Maharashtra)	03.02.2010
2.	Providing technical services for advice in proficiency testing and calculation of measurement uncertainty	Mahatma Gandhi Institute for Rural Industrialization, Wardha (Maharashtra)	03.02.2010

at the tip and 80% yellow-white at the base. Back side of the flower is red-purple (Red-Purple 72 B, Fan-2). (Breeder : Dr. RK Roy)

Speciality : Two tone colour combination (purple and yellow-white) and compact arrangement of florets makes the cultivar unique. There are few cultivars in blue-purple group. Therefore, this cultivar will be a new addition in this colour range.

3. NBRI-HIMANSHU

The new cultivar of chrysanthemum has been evolved by seedling selection from small flowered cultivars. Selection was made in 2007 and plants propagated vegetatively by cuttings and suckers. DUS testing was conducted in 2008 and the specimen plants were displayed in chrysanthemum flower show in the year 2008 and released in December 2009.



Plant attains height of 54 cm. with good spread of 45 cm (N-S) and 46 cm (E-W). It has well developed branch system and blooms in the month of December. Plant has floriferous blooming habit with more than one hundred flowers per plant. Average size of the flower is 8.5 cm across and the central disc is 4 cm. The beauty of this cultivar can be enjoyed at full bloom stage. At this stage from the polar view no leaf or branch of the plant is visible due to dense flowering. The main attraction of this cultivar lies in white flower head where ray florets and disc florets are arranged in a very systematic pattern. The flower is Anemone type with central star shape disc florets which are arranged in pin cushion fashion. Ray florets are emerging outside and have pure white colour (White Group 155 D, Fan-4). Disc floret colour is creamish white (Yellow Group 5B, Fan-1) which gives additional beauty to the flower.

PATENTS AWARDED

Sl. No.	Title	Inventors	Complete Filing Date	Country/ Grant date	NFNO
1.	Plant and soil health enhancer using cow urine and application thereof for promoting plant growth and controlling plant pathogenic fungi	Nautiyal CS, Mehta S, Singh HB, Mansinghka SB, Dawle SH, Rajhans NE and Pushpangadan P	31.03.2004	Australia/ 14. 01.2010	0070NF 2003/AU
2.	Antiarthritic herbal composition and method thereof	Pushpangadan P, Rao ChV, Govindarajan R, Ojha SK, Rawat AKS, Reddy GD and Mehrotra S	24.01.2008	US / 09.02.2010	0473NF 2003/US
3.	Synergistic antipyretic formulation	Pushpangadan P, Rawat AKS, Rao ChV, Srivastava SK and Khatoon S	29.12.2004	US/ 09.02.2010	0475NF 2003/US
4.	Synergistic herbal formulation as brain tonic	Pushpangadan P, Rao ChV, Goel RK, Acharya S, Somanathan M, Ramasami K and Mehrotra S	20.02.2004	India/ 28.01.2010	0470NF 2003/IN

PATENTS FILED

Sl. No.	Title	Inventors	Country	Filing Date	NFNO
1.	Novel process for developing insect resistance transgenic plants using ATMYB12 transcription factor	Trivedi PK, Misra P, Pandey A, Tiwari M, Chandrashekar K, Sidhu OP, Asif MH, Chakrabarty D, Singh PK, Nath P and Tuli R	India	07.01.2010	0002NF2010/IN
2.	Nucleic acid sequence encoding <i>Allium altaicum</i> agglutinin (AAA) and its use thereof	Singh PK, Upadhyay SK, Singh R, Rai P, Saurabh S, Singh H, Chandrashekar K, Verma PC and Tuli R	India	15.02.2010	0142NF2009/IN

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BOOK

Bhattacharya SK and Banerji BK – Complete Book of Roses. *Aavishkar Publishers and Distributors*, 807, Chaura Rasta, Jaipur – 302003, India, 2010 : pp. 521.

CHAPTERS IN BOOKS

1. Joshi S, Upreti DK, Punetha N and Rawat S – Diversity of lichens from the buffer zone of Nanda Devi Biosphere Reserve. *In* : Biodiversity of Western Himalayas. *Gyanodaya Prakashan*, Almora, 2010 : 397-416.
2. Suseela MR – Bloom and toxin occurrence. *In* : Cyanobacterial Harmful Algal Blooms (Ed. HK Hudnell). *Springer Science and Business Media*, LLC, New York, 2008 : 178-79.
3. Suseela MR – Conservation and diversity of fresh water algae. *In* : Biology and Biodiversity of Microalgae (Ed. N Anand). *Akshara Muthra Aalyam*, Anna Salai, Teynampet, Chennai, India, 2009 : 41- 42.

POPULAR ARTICLES

1. Anand P, Rawat KK and Verma PC – *Indopiptadenia oudhensis* (Brandis) Brenan : Monotypic, endemic and highly endangered taxa needs conservation in Uttar Pradesh. *BIODV News*, 2009, **1**(1) : 2-4.
2. Banerji BK, Gupta VN and Dwivedi AK – NBRI Vijay Kiran – a chrysanthemum cultivar evolved at National Botanical Research Institute, Lucknow. *Vatika*, 2009, **No. 4** : 28-30.
3. Upreti DK, Joshi S, Punetha N, Rawat S, Chandra S, Singh R, Singh PK, Tuli R, Verma PC, Singh R, Chandrashekar K, Saurabh S, Rai P, Singh R, Chandrashekar K, Verma PC, Singh PK and Tuli R – SUMO fusion facilitates expression and purification of garlic leaf lectin but modifies some of its properties. *J. Biotechnol.*, 2010, **146**(1-2) : 1-8.

3. Ph.D. THESES AWARDED

1. Ms. Meenakshi Mehrotra

Induction of high frequency somatic embryogenesis in grain legume chickpea for genetic transformation and expression of Bt-*cry1A* gene in transgenic plants

Guides : Dr. DV Amla, Scientist, NBRI, Lucknow and Prof. Dinesh Kumar, Lucknow University, Lucknow

University : Lucknow University, Lucknow

2. Mr. Saurabh Agarwal

Designing and PCR based assembly of modified gene coding human serum alpha-1-antitrypsin (AAT) protein for expression in dicot plants

Guides : Dr. DV Amla, Scientist, NBRI, Lucknow and Prof. Dinesh Kumar, Lucknow University, Lucknow

University : Lucknow University, Lucknow

3. Ms. Smrati Mishra

Studies on somatic embryogenesis in chickpea (*Cicer arietinum* L.) for genetic transformation and high level expression of heterologous protein

Guides : Dr. DV Amla, Scientist, NBRI, Lucknow and Prof. Dinesh Kumar, Lucknow University, Lucknow

University : Lucknow University, Lucknow

4. Mr. Vinay Sahu

Studies on the diversity and distribution of genus *Marchantia* L. under different environmental factors in Kumaon hills

Guides : Dr. V Nath, Ex Scientist, NBRI, Lucknow and Prof. Mohd. Yunus, BB Ambedkar University, Lucknow

University : BB Ambedkar University, Lucknow

4. LECTURES, SYMPOSIA, CONFERENCES, ETC.

LECTURES

1. SK Tewari, Scientist, delivered the following extension lectures :
 - i) 'Financing horticulture and organic farming', in the Orientation Programme for newly recruited officers of RRB, at BIRD (NABARD), Lucknow .. January 5, 2010
 - ii) 'Production of medicinal plants' in the Orientation Programme of UP Diversified Agriculture Support Project, at Horticulture Directorate, Lucknow .. January 19, 20 29 and 30, 2010
 - iii) 'High value financing : Medicinal and aromatic plants, floriculture etc.', at BIRD(NABARD), Lucknow .. February 23, 2010
2. Dr. RK Roy, Scientist, delivered the following lectures :
 - i) 'Production of flowers for commercial and other purposes', at Rafi Memorial Inter College, Barabanki .. January 22, 2010
 - ii) 'Hi-tech floriculture as a source of income', in the training programme for the VLFs of different districts of Uttar Pradesh', at Udyan Bhawan, Lucknow .. January 28, 2010
3. 'Role of constructed wetland in removal of Ganga water pollution' – MK Shukla, STA, in Ganga Jamuna Panchayat, Haridwar .. March 10, 2010
4. 'Plant-based management of Ganga water pollution' – UN Rai, Scientist, in the Save

Ganga and Save Himalayas Meeting-cum-Panel Discussion in Gandhi Darshan, at Rajghat, New Delhi .. March 12, 2010

5. Dr. BK Banerji, Scientist, delivered the following lectures to farmers, at Biotech Park, Lucknow, on March 12, 2010 :
 - i) 'Commercial floriculture'
 - ii) 'Dehydration of flowers and floral craft'
6. 'Importance of histological method in the standardization of Ayurvedic Drugs' – S Khatoon, Scientist, in the Training Programme for Young Scientists and Enforcement of GMP in Ayurvedic Industry, at Deendayal Research Institute, Chitrakoot .. March 28, 2010

CONFERENCES, SYMPOSIA, WORKSHOPS, ETC. ATTENDED AND PAPERS PRESENTED

CONFERENCES

1. Ms. D Nigam, SRF, attended the "Asia Pacific Bioinformatic Conference – 2010", at Indian Institute of Science, Bangalore, during January 18-21, 2010 and presented a poster entitled 'Global gene expression profiling of contrasting *Gossypium* spp. for deciphering highly stage specific genes and metabolic pathways governing good fibre quality' (D Nigam, Kavita P, A Ranjan, MH Asif, SS Mantri, SV Sawant and R Tuli).
2. Dr. AK Goel, Scientist, attended the National Conference on "Role of Biodiversity in Sustainable Agriculture", at Bundelkhand University, Jhansi, during March 4-5, 2010 and presented a paper entitled, 'Conservation and commercialization of ethnomedicinal

knowledge in India'. Dr. Goel also chaired one of the sessions.

3. Drs. AK Asthana, Scientist and V Sahu, STA, attended the International Conference on "Mountain Biodiversity", at Doon University, Dehradun, during March 13-15, 2010 and presented a paper entitled, 'Bryodiversity of Mukteshwar (Uttarakhand) : An overview' (AK Asthana and V Sahu).

SYMPOSIA

1. Ms. M Gupta and S Singh, Project Assistants, attended the 4th International Symposium on "Current Trends in Drug Discovery Research", at Central Drug Research Institute, Lucknow, during February 17-21, 2010 and presented a poster entitled 'Identification and quantification of biomarker ursolic acid in four *Swertia* species' (M Gupta, D Bisht, S Khatoon, S Rastogi, S Srivastava and AKS Rawat).
2. Dr. AKS Rawat, Scientist, attended AROMED International Symposium on "Current Status and Opportunities in Ayurvedic & Aromatic Medicinal Plants", at CIMAP, Lucknow, during February 21-24, 2010.
3. Dr. AK Sharma, Scientist, attended the National Symposium on "Plant Cell Tissue and Organ Culture : The Present Scenario", at University of Calcutta, Kolkata, during March 3-5, 2010 and delivered the invited lecture on 'Conservation of phytodiversity of some important medicinal plants including RET species through tissue culture'.
4. Drs. BK Banerji, RK Roy, Scientists and A Batra, T.O., attended the National Symposium on "Lifestyle Floriculture : Challenges and Opportunities", at Dr. Y. S. Parmar University of Horticulture & Forestry, Nauni, Solan, during March 19-21, 2010 and presented the following papers :

ORAL PRESENTATION

Banerji BK – Mutation breeding : An ideal and unique tool for genetic improvement of bougainvillea.

POSTER PRESENTATIONS

- i) Banerji BK and Dwivedi AK – Dehydration of African and French marigold flowers by embedding method.
- ii) Misra P, Banerji BK and Dwivedi AK – Dehydration of *Zinnia* by using microwave for value addition by embedding technique.
- iii) Misra P, Banerji BK and Kumari A – Effect of gamma irradiation on chrysanthemum cultivar 'Pooja' with particular reference to induction of somatic mutation in flower colour and form.
- iv) Roy RK – Indoor air pollution management by House plants – A new area with great applicability.
- v) Roy RK, Singh CP, Verma TS and Banerji BK – Effects of gamma irradiation on *Canna generalis* cv. 'Cleopatra' with reference to induction of somatic mutation in foliage and flower colour.
- vi) Saxena M, Dwivedi AK and Banerji BK – Effects of gamma irradiation on African marigold var. 'Pusa Basanti Gaiinda'.
- vii) Verma AK, Batra A, Misra P, Banerji BK and Dwivedi AK – Effects of ethyl methane sulphonate on chrysanthemum and induction of flower colour mutation.
- viii) Verma AK, Batra A, Misra P, Banerji BK and Dwivedi AK – Induction of flower colour mutation in chrysanthemum.

WORKSHOPS

1. Ms. I Trivedi, Project Assistant, attended the Indo-US Bilateral Workshop on "Plant Genomics in Crop Improvement with reference to Biotic and Abiotic Stresses", at CCS Haryana Agricultural University, Hisar, during February 25-27, 2010 and presented a poster entitled, 'The Histone H1.1 variant accumulates in response to drought stress in the drought tolerant variety of *Gossypium herbaceum*' (I Trivedi, A Ranjan, SV Sawant and R Tuli).
2. Dr. S Khatoon, Scientist, attended a Brainstorming Workshop on "Fundamentals of

Unani Systems of Medicine”, at CCRUM, New Delhi, on March 13, 2010.

CONVENTION

Messers SS Tiwari and D Verma, Project Assistants, attended the 4th National Convention of Society of Pharmacognosy, at Hindu College of Pharmacy, Sonapat, during February 20-21, 2010 and presented the following posters :

- i) Tiwari SS, Pandey MM, Srivastava S and Rawat AKS – Simultaneous determination of picrosides (Picroside-I and Picroside-II) in two *Picrorhiza* species through high performance thin layer chromatography.
- ii) Verma D, Srivastava S, Singh V and Rawat AKS – Pharmacognostic evaluation of *Curcuma caesia* Roxb.

MEETING

Dr. BK Banerji, Scientist, attended the meeting of Indian Society of Ornamental Horticulture, at Jawaharlal Nehru Communication Centre, Directorate of Extension Education, Dr. Y. S. Parmar University of Horticulture & Forestry, Nauni, Solan, on March 20, 2010.

EVENTS ORGANIZED BY NBRI

STUDENTS TRAINING AND AWARENESS PROGRAMMES

1. Under the CSIR Rural Development Project, the Institute had selected schools as Knowledge Dissemination Centres (KDC). During the month of January 2010, three training programmes were organized at three KDCs, viz., Jawahar Navodaya Vidyalaya (JNV), Pipersand, Lucknow, on January 8, 2010; JNV, Gauriganj, Sultanpur, on January 21, 2010 (including students from another KDC, Shri Rananjay Inter College, Gauriganj, Sultanpur) and Rafi Memorial Inter

College, Masauli, Barabanki, on January 28, 2010 to make students and teachers aware about NBRI rural development technologies. A total of 1170 students and 116 teachers from four schools participated in these training programmes.

Dr. SK Tewari, Nodal Officer, explained the concept of selecting schools as KDCs and highlighted various activities of the project. During these programmes, lectures and demonstrations on different components of the project were delivered by Scientists (co-PIs) and Project Assistants. The trainees were explained about the sodic land reclamation and utilization, floriculture crops (marigold, tuberose and gladiolus) and dehydrated floral crafts, importance of balanced fertilizer application, and use of vermi and NADEP compost, biofertilizers in existing cropping systems, propagation and cultivation of important medicinal plants, uses of locally available medicinal plants for primary health care etc. During the concluding session, an awareness programme-cum-quiz was organized. Students actively participated in awareness programme and attractive prizes (educational material) were distributed to them. Three sets of Extension Bulletins, Posters and Charts were provided to the Principals of all the four schools.

2. The Institute organized an Awareness Programme for Children with Bright Spark in Plant Science on February 19, 2010. The programme was sponsored by National Council for Science and Technology Communication (DST), Govt. of India, New Delhi. A total of 81 students from 10 different schools of rural and urban background participated in the programme. Dr. Rita Singh of Guru Govind Singh Indraprastha University, New Delhi, was the Chief Guest and inaugurated the programme.



Students during awareness programme and distribution of Extension Bulletins, Posters and Charts (right)

Dr. KC Gupta, Director, NBRI, introduced the Chief Guest and detailed about the importance and significance of the event.

Dr. J K Johri, Scientist, stated that the programme was planned considering the significance of the diversified plant genetic resources conserved in the Institute's Botanic Garden, in providing quality educational material for students, researchers, and teaching community. The Institute had published an illustrated descriptor and an awareness building calendar highlighting one of the interesting groups of plants known as Cycads in 2009.

Dr. Rita Singh described that Cycads are the remnants of the floristic elements that had originated on this planet for almost 165 million years ago. The existing cycad species have not changed or modified since then. Hence, it can serve as an excellent educational and research material to unravel the mysteries of reproduction, evolutionary and biological processes among this significant group of plants. In the end, Dr. AK Goel Scientist, proposed the vote of thanks.

3. Under the project "Faculty Training, Motivation and Adaptation of Schools and Colleges by CSIR Labs", a motivation and orientation training programme was organized by the Institute, during February 23-24, 2010, for science teachers of five adopted schools from rural parts of Lucknow. Out of five selected schools, the Science Awareness and Health Check-up Camps were also organized for students of three schools viz. Scholar's Study School, Ganga Ganj, Nagram Road, Lucknow; Adarsh Shiksha Sadan, Mirjapur Benti, Banthara, Lucknow and Ram Sewak Trivedi Balika Inter College, Itaunja, Lucknow. About 700 students

attended these camps.

FARMERS' INTERACTION PROGRAMME (KISAN SAMPARK DIWAS)

Under the Rural Development Project of CSIR, a Farmers' Interaction Programme (Kisan Sampark Diwas) was organized at Banthra Research Station of NBRI on March 30, 2010 for approximately 250 selected farmers of Lucknow and Sultanpur districts. The programme was meant for disseminating the NBRI Green Technologies among the farmers. The full day programme was inaugurated by Dr. KC Gupta, Director, NBRI. During the programme, ten activities, relating to NBRI Green Technologies, were displayed and extended through charts/ posters, models and extension bulletins (printed in Hindi). During this event, the visiting farmers had the opportunity to interact with scientists, dealing with several NBRI technologies,



A view of the inaugural session of Kisan Sampark Diwas

understand the technological details, visit the field demonstrations and get their soil samples tested on the spot along with advice/recommendation on reclamation and management. The registered farmers were provided with biofertilizers (*Trichoderma* and PSB), seeds/seedlings/ planting materials of identified crops like tuberose, marigold, gladiolus, turmeric, shatavari, ashwagandha (variety NMITL118), and vermicompost etc.

5. TECHNICAL AID, ADVICE AND TRAINING

TECHNICAL AID AND ADVICE

Gamma irradiation facilities were provided to the following :

1. Ms. Ayushi, Research Scholar, Dr. Y. S. Parmar

University of Horticulture and Forestry, Nauni, Solan, H. P.

2. Ms. Pooja Kaintura, Research Scholar, G. B. Pant University of Agriculture and Technology, Pantnagar.

TRAINING

TRAINING IMPARTED

a. Group Training

Sl No.	Number of Candidates	Subject of the Training	Sponsoring Agency	Date(s)
1.	700 students	Dehydration of Flowers and Floral Craft	CSIR, New Delhi	21.01.2010
2.	250 students	Dehydration of Flowers and Floral Craft	CSIR, New Delhi	28.01.2010
3.	60 farmers from different districts of U.P.	Commercial Floriculture	UPDASP, Lucknow	01.02.2010 to 03.02.2010 & 10.02.2010 to 12.02.2010

b. Individual Training

- Ms. Anju Kumari, Banasthali Vidyapeeth, District Tonk, Rajasthan, was imparted training on “Induction of Mutation and Tissue Culture”, during January 11 – May 10, 2010.
- Ninety-nine students of different universities/institutes were imparted training on various topics of their interest, during the period under report.

TRAINING RECEIVED

Sl. No.	Name of Scientist(s)	Subject of training Course	Organizers/Place	Date/Period
1.	Dr. S Rastogi	FP7 Health Info Day & Training	CDRI, Lucknow	March 12, 2010
2.	Dr. PK Srivastava	Internal Auditor Course as per ISO/IEC 17025	TUV SUD South Asia at New Delhi	March 29-31, 2010

6. ANNUAL ROSE AND GLADIOLUS SHOW

The most enchanting and well-known event of NBRI, the **Annual Rose and Gladiolus Show**, was organized by the Institute, during January 16-17, 2010 at its lush green Central Lawn. This year, the show attracted a total of 446 entries belonging to a large number of competitors from Lucknow and outstation. Prof. MK Mishra, Vice-chancellor, Lucknow University, Lucknow, was the Chief Guest. In all, 227 prizes, besides 26 running challenge cups/shields/

trophies, were awarded at the prize distribution function by Prof. Mishra on January 17, 2010.

This year, Hindustan Aeronautics Ltd. (HAL), Lucknow, stole the show by lifting as many as 10 running challenge cups/shields/trophies; followed by Director, CIMAP, Lucknow, who secured the second position by winning 4 challenge cups/shields/trophies. The prize for the best rose of the show was won by HAL, Lucknow, while for the best gladiolus



Left : Judging in progress; Right : Prof. MK Mishra going round the show

spike of the show was lifted by Mr MM Beg, Thakurganj, Lucknow.

On the occasion, a theme pavilion was also organized by NBRI. The main purpose was to showcase elite germplasm collections of rose and gladioli, maintained by the Institute in a categorized way. In gladioli, 50 cultivars were displayed under the theme germplasm collections, commercial cultivars and new NBRI hybrids. Simultaneously, 95 cultivars of roses were also displayed in different categories namely – hybrid tea, floribunda, polyantha, miniature and climbers. Seven Gerbera cultivars and 30 medicinal plants were also displayed. Gladiolus cultivars included two new varieties viz. 'Roshni' and 'Amethyst'.

Dr. R Tuli, the then Director, NBRI, Lucknow, while welcoming the guests, told that the Institute

had been organizing the flower shows every year. He further added that flowers convey a special message through its diversity. A lot of R & D work is being carried out globally in developing new varieties of roses. He said that roses have a huge international market to the tune of Rs. 5000 crores and India's contribution is insignificant.

Prof. MK Mishra, while appreciating the efforts of NBRI, said that trees and flowers are very significant in Indian culture. Flowers convey special message in terms of spreading its fragrance to everyone without discrimination. He appreciated the role of NBRI in benefitting the floral lovers and farmers through introducing new varieties and expressed that NBRI would contribute significantly in development of floriculture especially in bridging the gap in international market. In the end, Dr. AK Goel, Scientist, proposed the vote of thanks.

7. IMPORTANT EVENTS

REPUBLIC DAY

The Republic Day was celebrated on January 26, 2010 when Dr. P Nath, Senior-most Scientist, unfurled the National Flag and addressed the members of staff. Sweets were also distributed on the occasion.

NATIONAL SAFETY DAY

The National Safety Day was observed by the Institute on March 4, 2010. The National Safety Pledge was administered to the members of staff by Dr. P Nath, Senior-most Scientist, NBRI, Lucknow.

8. PERSONALIA

HONOURS AND AWARDS

1. Dr. CS Nautiyal, Scientist, has been conferred upon "**TATA Innovation Fellowship**", for his eminence and contributions in the field of microbial technology for enhancing the yield of plants that maximizes the economic, environmental and societal benefits to the people of India. The prestigious fellowship has been instituted by the Department of Biotechnology, Government of India, to recognize and reward scientists with outstanding track record in biological sciences and a deep commitment to find innovative solutions to major problems related to life sciences and biotechnology.



2. Dr. RK Roy, Scientist, has been awarded with **Dr. B. P. Pal Award, 2010** by the Bougainvillea Society of India & International Centre of Registration

Authority for Bougainvillea, Division of Floriculture & Landscaping, IARI, New Delhi for significant contributions towards maintaining large collections of named varieties of Bougainvillea at NBRI, Lucknow.

3. Dr. S Tiwari, Scientist, has been conferred upon the **Indian Science Congress Young Scientist Award** for the year 2009-2010. The award was presented by the former President of India, Dr. APJ Abdul Kalam, during the 97th Indian Science Congress, held at Kerala University, Thiruvananthapuram, on January 5, 2010. Dr. Tiwari was also awarded with the **Dr. YSR BioAsia Innovation Award 2010** for his proposal "Recombinant Peanut Seeds Based Anit-Cholera Rabies Fusion Vaccine" in Bio Asia 2010 – The Global Bio Business Forum, held at Center for Biotechnology, University of Hyderabad, Hyderabad,



during February 3-10, 2010. The award was given by His Excellency Shri ESL Narasimhan, Governor, Andhra Pradesh.

4. Dr. MK Shukla, STA, was awarded with **Bhojpuri Vigyan Gaurav**, at Bhojpuri Mahotsav, held at Lucknow, during March 5-9, 2010.

APPOINTMENTS

1. Ms. A Krishna, Proj. Asstt. .. January 11, 2010
2. Mr. Durga Prasad, Proj. Asstt. .. January 25, 2010
3. Mr. SR Khan, Proj. Asstt. .. January 25, 2010
4. Dr. (Mrs.) Sapna Verma, Proj. Asstt. .. February 5, 2010

5. Ms. P Singh, Proj. Asstt. .. February 26, 2010
6. Mr. P Kumar, Proj. Asstt. .. March 29, 2010

PROMOTIONS

Following members of staff were promoted under CSIR SRAP Rules 2001 w.e.f. the dates noted against each :

From Scientist 'F' Gr. IV(5) to Scientist 'G' Gr. IV(6)

1. Dr. PB Khare .. April 16, 2008
2. Dr. CS Nautiyal .. February 1, 2009

RETIREMENTS

Dr. (Mrs.) VL Goel, Scientist 'F' .. March 31, 2010

DR. P PUSHANGADAN HONOURED WITH **PADMA SRI**

Dr. P Pushangadan, Ex-Director, NBRI, Lucknow, was conferred upon the **Padma Sri** by Honourable President of India, Smt. Pratibha Patil, on March 31, 2010, at Rashtrapati Bhavan, New Delhi.



Dr. P Pushangadan receiving *Padma Sri* by Smt. Pratibha Patil

Dr. Pushangadan was instrumental in establishing Ethnopharmacological research in India which has received national and international acclaims. He and his team were able to make interesting pharmaceutical discoveries

through an integrated research and combined the wisdom of the traditional systems of medicines and the modern scientific knowledge, tools and technology.

At present, Dr. Pushangadan is Director General, Amity Institute for Health and biotech Products Development, Thiruvananthapuram and Senior Vice President of Ritnand Balved Education Foundation, New Delhi (Amity Group of Institutions).

CORRIGENDUM ANNUAL REPORT 2008-09

Research papers published during the period and as listed in the annual report of 2008-09 at Sl. Nos. 17, 19, 37, 63, 65, 66, 91, 126, 128 and 134 have inadvertently been repeated from the AR 2007-08 whereas Sl. No. 144 and Review 11 have been duplicated. The editorial board regrets the inconvenience.

FORTHCOMING EVENTS

INDEPENDENCE DAY	..	August 15, 2010
SADBHAVNA DIWAS	..	August 20, 2010
HINDI DIWAS	..	September 14, 2010
CSIR FOUNDATION DAY	..	September 26, 2010

To,

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