Research Highlights

Agro-inoculation studies with infectious clones of ToLCNDV-[potato] isolates

Infectious clones consist of partial tandem repeats of viral genome in the binary vector and preferentially delivered through Agrobacterium tumefaciens, known as agro-inoculation. These clones are developed to characterize a virus at the molecular and biological levels and also for the evaluation of resistance to viruses. This technique is widely adopted in geminiviruses because they carry a simple genome. In potato, apical leaf curl disease is caused by a whitefly transmitted geminivirus, Tomato leaf curl New Delhi virus-[potato] (ToLCNDV-[potato]). In this study, infectious clones of three ToLCNDV-[potato] isolates (MOD-21, FAI-19 & KAN-6) obtained from potato fields of Modipuram, Faizabad and Kanpur were developed and used in symptom expression studies in N. benthamiana and potato plants through agro-inoculation. These isolates produced different type of symptoms both in N. benthamiana and potato. Severe symptoms of yellow mottling, downward curling and stunted growth were observed in N. benthamiana plants inoculated with KAN-MOD-21 inoculated plants showed downward curling, stunted growth, but yellow mottling was observed only in older leaves. While, FAI-19 inoculated plants produced only downward curling symptoms. In case of potato, typical symptoms of apical leaf curl disease were observed in cultivar Kufri Pukhraj inoculated with MOD-21 and KAN-6 that are similar to those produced by virus infected plant. FAI-19 produced only restricted yellow spots in Kufri Pukhraj. Mild symptoms appeared in KAN-6 and no symptoms were observed in MOD-21 and FAI-19 inoculated Kufri Bahar plants which is known to show lowest seed degeneration under field conditions. Analysis of genomic components indicated that these isolates had 94.8 – 94.9 % and 87.9 – 97.3 % identity among them in DNA A and DNA B, respectively. The results of the study indicate the association of three ToLCNDV-[potato] isolates of different symptomatology with apical leaf curl disease of potato. This is also a first experimental demonstration of Koch postulate for a begomovirus associated with apical leaf curl disease of potato.

A. Jeevalatha, G. Vanishree, S. Sundaresha, R. Kumar, P. Kaundal, A. Kumar & S.K. Chakrabarti

Whitefly pot/bucket trap developed

A trapping device was developed and used for whitefly, Bemisia tabaci (Gennadius) sampling in potato fields to obtain an absolute estimate of the number of whiteflies per plant and for large scale collection of the whitefly adults. The trapping device, known as the pot/ bucket trap, consists of an opaque bucket/flowerpot, 5 to 15 litre capacity. A hole is drilled in the bottom of the flowerpot/bucket and provided with foam pieces on the outside to support a plastic vial in upright position. The trap is placed upside down over one plant and a translucent plastic vial is placed over the hole in the centre.
of the bottom with the opening of the vial facing the plant inside the pot.

The whiteflies being highly photo-kinetic, move towards the light coming through the translucent plastic vial. They take off from the leaves of the plant held in darkness and fly to the light inside the vial. Within minutes most of whiteflies on the plant move into the plastic vial and can be collected from there.

The trap allows assessment of the number of whiteflies per plant by counting the number of whiteflies in the plastic vial. The live whiteflies caught can be used for various experimental studies such as virus transmission, bionomics and molecular biology experimentation. The trap is zero energy and can be made from recycled material. It can be customised for use in different crops and conditions.

Mohd Abas Shah, Brajesh Nare & Sanjeev Sharma

R8 is the new player in late blight resistance in K. Girdhari and its male parents

Late blight (LB) of potato caused by Phytophthora infestans is the major threat to potato production. The molecular mechanism underlying the broad spectrum resistance to late blight in S. demissum involves an R8 gene that recognizes Avr8 and therefore we have investigated the role of R8 in Kufri Girdhari (KG) cultivar. This resistant cultivar along with susceptible cultivar Kufri Bahar (KB) was artificially inoculated with Phytophthora infestans. Expression of R8 gene was analyzed by qRT-PCR after observing symptoms of late blight on susceptible cultivar, where it showed remarkable expression in KG compared to KB confirming R8 gene to be responsible for conferring broad spectrum resistance. KG was bred by pollinating K.

Megha with bulk pollen from ten accessions. To identify the exact male parent of KG the SSR fingerprint analysis were performed along with qRT-PCR analysis. The results of these experiments showed CP3789 to be the probable male parent of KG.

SSR marker profile of the CP3789 showing the similarity with the KG.

Hemant Kardile, N.K. Sharma, Vinay Bhardwaj, A. Kumar & S.K. Chakrabarti

Seed Potato Databank: A web based tool

Seed information is a vital component of potato production programme. Frequently, documentation on seed source, quality, variety and availability is poor.

During the last 10–15 years, computer techniques have been increasingly utilized within the field of seed supply through establishment of database systems for seed
management at seed centers. An effort has been done in compilation and digitization of seed potato production and supply to different states as per the demand from Department of Agriculture and Co-operation (DAC) and other organizations. The process of development of Seed Potato Databank involve the preparation of database using SQL Server 2008 R2 Edition at the back-end and the front-end is designed using DOT NET technology with C#. Four front end forms are designed for the users, which enable the users to search the variety details like variety name, location in which it is grown, area and production in different years. This will help the seed producers/entrepreneurs/pvt. Organizations and policy makers for the future roadmap of seed potato production and multiplication as per the demand and supply of the potato varieties, respectively. This web based tool also helps in better understanding of the supply of Indian potato varieties seed in different states in different year. This tool also provides information on area, production and productivity of potato varieties in a particular year across hills and plains of India.


### Transfer of Technology

#### Summer School organised at ICAR-CPRI, Shimla

ICAR-CPRI Shimla organized a 21 days Summer School training programme on “Recent advances in crop improvement, production and post-harvest technology in potato research” during 18th July to 7th August, 2017. The objective of the training programme was to enhance the knowledge and skills of trainees regarding the recent advances in potato technologies. A total of 25 trainees which include scientists and teaching staffs from SAUs and ICAR attended the programme. A number of training methodologies like lecture cum discussion, practical sessions, skill demonstration, field visits and video film show, etc were implemented during the summer school. Majority of the trainees were highly satisfied with the training programme.

**A Chat Show was organized at CPRS, Kufri**

A Chat Show was organized at CPRS, Kufri on “Potato Cultivation: Problems & Remedies” by Shimla Doordarshan. The programme was attended by 25 farmers (men & women) from Cheog panchayat adopted villages under Mera Gaon Mera Gaurav. The programme had been broadcasted by Shimla Doordarshan on 4th July, 2017 and DD Kisan on 13th July, 2017 for the benefit of farmers.

**ICAR-CPRI Shimla organized an exhibition during 69th Foundation Day**

ICAR-CPRI Shimla organized an exhibition during 69th Foundation Day of the Institute on 28th August, 2017 at CPRI Shimla. Many progressive farmers also exhibited
their produce during the event. About 100 farmers and school children participated in the programme and visited the exhibition stall. Various technologies of the institute like live sample of potato varieties, processed products, True Potato Seeds (TPS), minitubers from net house, microtubers from aeroponic system, virus testing kits etc. were displayed during the exhibition. In addition to farmers and school children, a large numbers of visitors which includes MPs, scientists, policy makers, entrepreneurs and other stakeholders in agriculture and allied activities visited the stall and they were made aware about various technologies of the institute.

**Two days Training Program on Scientific potato cultivation at Shimla**

A two day on campus Training Programme was organized by CPRI Shimla for 15 officers of Mahindra Agri. Solution Ltd. on 7th to 8th September, 2017. The training programme was sponsored by Mahindra Agri Solution Ltd., Mumbai. Different aspects of potato cultivation like planting, irrigation, disease pest management etc were delivered to the trainees by the expert scientists from the institute. Lecture-cum-discussion, video shows, demonstrations, practical exercises, field and lab visit, etc were the modes for imparting training to the participants.

**ICAR-CPRI, Shimla participated in Kisan Mela at ICAR-DMR, Solan**

ICAR-CPRI Shimla participated and put up an exhibition stall in *Kisan Mela* during “New India Manthan-Sankalp se Sidhi Programme” at ICAR-DMR Solan on 19th August 2017. The kisan mela was organized by KVK Kandaghat. A large number of farmers, scientists, students, policy makers, manufactures, companies, NGO members, women entrepreneurs and other stakeholders visited the CPRI stall. The visitors were provided with technical bulletins, folders, etc free of cost.

**ICAR-CPRI Shimla participated in Mushroom mela at ICAR-DMR, Solan**

ICAR-CPRI Shimla participated and put up an exhibition stall at ICAR-DMR Solan on 9th September, 2017. Various technologies of the institute were displayed during the exhibition. About 300 farmers visited the CPRI stall and they were made aware about various technologies of the institute. A large number of scientists, students, policy makers, manufactures, companies, NGO members, women entrepreneurs, etc also visited the CPRI stall. Technical publications were distributed during the mela.

**Live Phone-in Programme at Doordarshan**

Scientists from CPRI, Shimla participated in the Live-phone programmes on different subjects on Doordarshan from July to September, 2017. The details of the topics along with experts are given below.

<table>
<thead>
<tr>
<th>Month</th>
<th>Topics</th>
<th>Name of the Expert</th>
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| July  | Diseases and pests of potato and their management | Dr. Vinay Sagar  
Dr. Ravinder Kumar |
| August| Intercultural operations in potato cultivation in HP | Dr. Jagdev Sharma  
Dr. Tanuja Buckseth |
| Sept. | Harvesting, safe storage and marketing of potato | Dr. Pinky Raigond  
Dr. NK Pandey |

**Important Meetings, Events & Visitors**

**National Seminar on Sustainable Potato Production**

A one day seminar on “Sustainable Potato Production – issues and strategies” was held at BCKV, Kalyani (WB) on
15.09.2017. The seminar was jointly organized by the ICAR – Central Potato Research Institute, Shimla, Bidhan Chandra Krishi Viswavidyalaya (BCKV), Kalyani and Indian Potato Association, Shimla. The inaugural function was presided over by Hon’ble Vice Chancellor, Dr. DD Patra. Sh. Pradip Majumdar, Advisor (Agriculture) to Chief Minister of West Bengal was the Chief Guest and Dr. Tapas Mandal, Hon’ble MP Lok Sabha, Prof Srikumar Pal, Director Research, BCKV, Kalyani, Dr. T. Janakiram, ADG (Horticultural Science-II) were the Guests of Honor. Dr. SK Chakrabarti, President, Indian Potato Association and Director, ICAR – Central Potato Research Institute, Shimla gave an overview of the seminar in the inaugural session. ADG (Hort.) Dr. Janakiram applauded the efforts of IPA and ICAR-CPRI towards the sustainable potato production. Dr. Majumdar mentioned that most of the potato farmers in West Bengal are small and marginal farmers and research efforts should be made to improve their livelihood. Dr. Mandal stressed that efforts should be made for dissemination of the developed technologies. The seminar had focus on identifying suitable high yielding ware and processing varieties for different potato growing zones, innovative crop production technologies for doubling farmers’ income, adaptation strategies to climate change and tropicalisation of potato, enhancing total factor productivity, delineating areas with common agroecologies and varieties suitable for them, SWOT analysis of potential technologies, approaches, challenges and technologies to produce healthy potatoes and to reduce post-harvest losses. In the seminar three lead lectures were delivered. Dr. BP Singh, Former Director, ICAR – CPRI Shimla delivered a lecture on potato seed production systems – then and now. Dr. PS Naik, Former Director, ICAR – IIVR, Varanasi presented SWOT analysis of potato in India and Dr. PM Govindakrishnan, Former Project Coordinator, AICRP (Potato) made a presentation on Enhancing potato production in India – the sustainability conundrum. The seminar was attended by about 150 participants which included researchers, entrepreneurs and potato growers.

National Training on Procurement & PFMS for ICAR Officers organised at ICAR-CPRI Shimla

The rapidly changing scenario in public procurement and fund management system necessitated an extensive training program on Procurement & PFMS by way of bringing together the knowledge domains and utilizing it to smoothen the transition phase of adopting these new systems by ICAR institutes. ICAR-CPRI Shimla having implemented the changes in its work processes & having reasonable expertise in these areas conducted a national level training program for capacity building & abridging knowledge gap of ICAR personnel at Shimla from 11th Sept. to 17th September, 2017.

As addressed by Institute Director Dr. S K Chakarbarti during the opening address of the programme that in recent past there has been a paradigm shift in procurement processes with advent of a new GFR, a new purchase manual, e-procurement, GeM and a new taxation system in form of GST. Further, with PFMS also being made mandatory in the fund flow management system and it being intricately linked with procurement, training on PFMS was also conducted during this period.

The 5 day intensive training programme covered lectures on topics like Over view of purchase, Changes in GFR, Bid document framing, Bid evaluation, Procurement of services, Works, Import management, Contract labour hiring & management, Contract order drafting etc. Lectures as well as extensive hands on training on computers to all participants was imparted on PFMS, GeM, e-Procurement etc.

Around 80-85 participants from 37 different institutes/centres attended the training programme. Apart from the in house ICAR-CPRI faculty that included Sh GC Prasad, Sr FAO & Sh Sandeep Singh Dudi, AO, expert faculties in respective fields from ICAR HQ, Banks, INST Mohali, IWWBR, Karnal & CSSRI Karnal also delivered lectures.
On learning outcome front, the gap analysis of Participants saw the rise in mean score from 6.18 before training to a score of 10.2 post training indicating a 65% knowledge add on during this course. An exceptionally great feedback on all fronts by all participants of this course underlines the success of the 5 day long interactive training process.

**DG ICAR & Secretary (DARE), Dr. Trilochan Mahapatra visited CPRS, Gwalior**

Dr. Trilochan Mahapatra, Secretary (DARE) and Director General (ICAR) visited, ICAR-CPRS, Gwalior on 29.07.2017 along with Dr. SK Srivastava, Director, Extension, Rajmata Vijay Raje Scindia Krishi Vishwavidyalaya, Gwalior and Dr. Anupam Misra, Director, ATARI (Zone-VII), Jabalpur. Hon'ble DG, ICAR discussed about activities of the station along with staff members in relation to seed production, scientific activities / achievements and its impact in the state of Madhya Pradesh. He appreciated the efforts of the station for breeder seed production, especially for catering the need of Madhya Pradesh as well as other states of the Country. He graced the occasion by planting saplings of Mango and Guava along with other dignitaries.

![DG ICAR & Secretary (DARE), Dr. Trilochan Mahapatra visited CPRS, Gwalior](image)

“New India Manthan: Sankalp se Siddhi Programme”. In his address, the chief guest mentioned about the ongoing programmes of the present government like Jan Dhan Yojana, Swachh Bharat Abhiyan, per drop more crop, soil health card campaign, balanced use of fertilizers and pesticides and National Agricultural Marketing (e-NAM), etc to double the income of farmers. A film sent by the Ministry of Agriculture & Farmers Welfare was shown to the audiences. A pledge for New India by doubling farmer's income was taken by all participants. Dr. HC Sharma emphasized on water conservation and its judicial use, dwarf root stocks, high density planting, judicial use of pesticides and use of locally available materials to double the income of farmers.

During the programme, progressive farmers were honored by the chief guest by presenting them awards. An exhibition was also organized in which many progressive farmers took part by exhibiting their produces. About 100 farmers and school children participated in the programme. Three publications were released on this occasion, namely “Potato statistics: India and World”, “Seed Potato Production Techniques” and “Sankalp se Siddhi: New India Movement”. The CPRI Best Worker Awards were also given to the staff in scientific, technical, administrative and supporting categories during the event.

**ICAR-CPRI celebrated New India Manthan: Sankalp se Siddhi programme and 69th Foundation day**

ICAR- CPRI Shimla celebrated “New India Manthan: Sankalp se Siddhi programme” and 69th Foundation day on 28th August, 2017. The programme was inaugurated by the chief guest, Shri Virender Kashyap, Honorable Member of Parliament from Shimla constituency in the present of Shri Rakesh Kumar Sharma, Deputy Mayor, Municipal Corporation, Shimla, Dr. H.C. Sharma, Vice Chancellor, Dr. Y.S. Parmar University of Horticulture and Forestry and other dignitaries. Dr. S.K. Chakrabartii, Director, CPRI Shimla welcomed all the dignitaries and briefed them about the achievements of the institute and the plan for the coming five years (2017-2022) in relation to

**Hindi Pakhwada -2017**

Hindi Pakhwada was organized during 14-28 September, 2017 at Central Potato Research Institute, Shimla. On the occasion of inauguration ceremony, Dr. K.K. Pramanick, Head, IARI Regional station, Amartara Cottage, Shimla was the chief guest of the function. He first congratulated to all officers/employees of the Institute for Hindi Pakhwada. He told that Himachal Pradesh comes under 'A' category, therefore, the offices of all Central Government Departments come under 'A' category and target for these have been kept as 100 percent for all correspondence in Official Language. To achieve this, all
the staff should use more and more Hindi in the daily work of their office. He also urged to all staff of the Institute to participate eagerly during various competitions to be organized on the occasion of Hindi Pakhwada. Official language and prize distribution program was held in the Institute on 12.10.2017. On the occasion, cash prizes were rewarded to the winners who received first, second, third and consolation place in Hindi competitions by the Chief Guest, Dr. Om Prakash Saraswat, Former Head of the Department of Hindi, H.P. University, Shimla. During the year 2016-2017, officers and employees working well in Hindi throughout the year were also awarded with cash prize money.

On this occasion, he congratulated all the award winners. In his address, Dr. Saraswat said that since the major population of the country speaks and understand Hindi, it is not only official language but it is also established as a national language. Therefore, it is the collective responsibility of all of us that it should be given proper respect by using this language more and more. Dr. Swaroop Kumar Chakrabarti, Director of the Institute, told in his address that it is a research institution, so doing all the work in Hindi is not very easy, but still most of the administrative work is done by the institute in Hindi only, which is a commendable step. He again called upon the officers/staff of the institute to do their daily administrative work in Hindi as far as possible so that the roadmap of the Official Language Department can be made easier.

In charge of the institute (Rajbhasha) Dr. Rakesh Mani Sharma said that our office comes under ‘A’ category and so far correspondence by the institute is about 83 percent. He said that we have to work together to achieve 100 percent target set by the official language department.

**Swachhta Hi Sewa campaign celebrated at ICAR-CPRI, Shimla**

As per the instructions of the council, “Swachhta Hi Sewa” campaign was observed at ICAR-CPRI, Shimla. Under the campaign, cleaning and sweeping of all toilets was done at the HQs at Shimla and its regional stations. Whole staff of the Institute participated in the activity.

On 25th September, 2017, Sarwatra Swachta was celebrated at the Institute. During this celebration, every employee of the Institute and its regional stations participated in the swachhta activities like cleaning of drains, retaining walls, roofs, surroundings roads nearby the campus etc. Apart of these activities, tree plantation was also done at regional stations of the institute during the campaign period.

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**Human Resource**

**Scientific Transfers**

1. Dr. Vinod Kumar, Principal Scientist from CPRS, Kufri to CPRI, Shimla on 06.7.2017.
3. Sh. Pynbianglang Kharmunid, Scientist from CPRS, Patna to CPRI, Shimla.
4. Dr.(Mrs.) Jeevalatha A, Scientist from CPRI, Shimla to IISR, Calicut Kerala on 07.7.2017.
5. Dr. Raja Shankar, Sr. Scientist from CPRI, Shimla to IIHR, Bangalore.
6. Sh. Maharishi Tomar, Scientist from CPRI, Shimla to ICFR, Jhansi.
7. Sh. Shreedhar Janardhanpuli, Scientist from CPRI, Shimla to NIBSM, Raipur, Chattisgarh.
Technical Promotions

2. Sh. Kameshwar Sen, Sr. Tech Officer, CPRI, Shimla promoted to Asstt. Chief Tech. Officer w.e.f. 5.1.2016
3. Sh. Naresh Kumar Sharma, Sr. Tech. Asstt. CPRI, Shimla promoted to Tech. Officer w.e.f. 16.6.2017
4. Sh. Ranjesh Bhardwaj, Tech. Asstt. CPRI, Shimla promoted to Sr. Tech. Asstt. w.e.f. 7.6.2017
5. Sh. Naresh Kumar, Tech. Asstt. CPRI, Shimla promoted to Sr. Tech. Asstt. w.e.f. 15.4.2017
7. Sh. Sita Ram Technician, CPRI, Shimla promoted to Sr. Technician w.e.f. 6.8.2017.
8. Sh. Laiq Ram, Technician, CPRI, Shimla promoted to Sr. Technician w.e.f. 7.8.2017
10. Sh. Pawan Kumar, Technician, CPRS Jalandhar promoted to Sr. Technician w.e.f. 6.8.2017

Retirement/Death

1. Sh. Bhag Singh, Driver, CPRS Jalandhar retired on 31.7.2017
2. Sh. Sanadkar Kumar, Sr. Tech. Officer, CPRIC, Modipuram died on 5.8.2017

Administrative Promotions

1. Sh. Rakesh, UDC, CPRS, Jalandhar promoted to the post of Asstt. w.e.f. 11.9.2017
2. Sh. Mohinder Singh, LDC, CPRI, Shimla promoted to the post of UDC w.e.f. 08.9.2017
3. Sh. Narender Paul, LDC, CPRI, Shimla promoted to the post of UDC w.e.f. 08.9.2017
4. Smt. Sneha Lata, LDC, CPRIRS, Modipuram to the post of UDC w.e.f. 11.9.2017
5. Smt. Sona Verma, LDC, CPRIRS, Modipuram to the post of UDC w.e.f. 15.9.2017

Skilled Supporting Staff New Appointment

1. Miss Kiran, Skilled Support Staff, CPRI, Shimla joined on 18.8.2017 (FN) on compassionate ground.

From the Director’s Desk

In the coming centuries feeding the ever-increasing global population is a serious challenge, when recent study shows yield stagnation in many field crops including potato. Food availability is a major problem particularly in the developing nations, where degrading soil health, little access to costly inorganic fertilizers specially nitrogen (N) and limited cultivable land are main constraints. It is a fact that nearly 40-60% of crop yields are responsive to N fertilizer input, where more than 100 million tonnes of N fertilizers are applied annually to crops worldwide. Potato, being the third most important food crop in the world in terms of human consumption, acquire nearly 40-50% of the applied N while remaining N lost in the environment. Moreover, with the continued dependence on high demand of N fertilizers for crop yield, its prices are anticipated to remain high in the future. Hence, enhancing nitrogen use efficiency (NUE) of potato plant may be one of the key genetic approaches to augment the global food demand. Since, plant N uptake and its regulation is a complex system, researchers have attempted to delineate the underlying mechanism of NUE. However, success in releasing NUE genotypes has been limited may be due to its complex genetics and interactions with environmental variables.

Potato is an exhaustible and resource intensive crop, especially costly input like N to achieve tuber yield and tuber quality. To increase potato production in an environmentally sustainable manner, improving NUE of the potato plant can be a key approach. NUE may be defined as: crop yield or dry matter per unit of soil N supply (fertilizer + residual N). NUE can be achieved in two ways: i) agronomy and soil management, and ii) crop improvement. Former highlights precision in N fertilizer management like available soil N and crop demand, controlled release fertilizers, sensors, information technology and advanced estimation of N requirements for improving NUE. Latter, focuses on improving plant genetic potential through N uptake efficiency (NUpE: plant N content per unit of soil N supply) and N utilization efficiency (NUE: plant dry matter production per unit of plant N content).

In India, a mature crop of potato yielding 25-30 t/ha tubers removes 120-140 kg N/ha with recommended N fertilizer dose (150-200 kg N/ha). The Indian soils are generally deficient in organic matter thus unable to release N at the rate required to maintain adequate supply to the growing plant. Application of inorganic N fertilizers is inevitable to meet the crop N demand. Hence, developing nitrogen use efficient potato varieties can be one of the plausible options to grow potato with less N input. Previous studies at our institute have shown that Kufri Gaurav is the most N efficient potato variety among more than 50 varieties released by ICAR-CPRI, Shimla. Kufri Gaurav yields at par with Kufri Pukhranj at 75% N of the recommended dose. The institute is actively working to gain knowledge at gene level and uncover the N metabolism mechanisms in these varieties applying advanced genomics tools.

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Published by : Director, ICAR-Central Potato Research Institute, Shimla-171 001, H.P. (India)
Secretarial Assistance : Sachin Kanwar
Phone : 0177-2625073, Fax : 0177-2624460, E-mail : director.cpri@icar.gov.in, website: https://cpri.icar.gov.in
Printed at : Azad Offset Printers, Press site, Industrial Area, Phase-I, Chandigarh
Ph. : 0172-4611489, 2656144, 2657144, 9814011543

July - September, 2017