

From the Director's Desk

Management of *Sclerotinia* rot of Rapeseed-Mustard through IPM Interventions



Oilseed Brassicas, rapeseed-mustard are the world's third most important source of vegetable edible oil. Among more than thirty diseases known to occur on *Brassica* crop in India, *Sclerotinia* rot earlier considered to be a minor problem, has become a serious problem of rapeseed-mustard in India. The *Sclerotinia* rot is known by various names such as cottony rot, watery soft rot, stem rot, white blight and white rot. *Sclerotinia* rot incited by *Sclerotinia sclerotiorum* (Lib.) de Bary has emerged as the most serious fungal disease of rapeseed–mustard in Haryana and Rajasthan in the recent times which causes serious damage at various crop growth and seed development stages resulting in heavy losses to crop yields. This

disease is also reported from the States of Assam, Bihar, Punjab, Himachal Pradesh, Delhi and Uttar Pradesh.

The maximum *Sclerotinia* rot incidence recorded in field of Rapeseed-Mustard growers was 90 per cent where seed yield was estimated to be reduced by 60 per cent, which indicates the importance of the disease. Symptoms of *Sclerotinia* rot appear after flowering stage; infection is related to emergence of abscised petals which are colonized by *S. sclerotiorum*. The first symptoms are seen on leaves as light brown water soaked spots which rot very quickly in moist weather. The disease appears as elongated, water soaked lesions on stem which are covered with cottony mycelial growth later on. The affected plants show stunting and premature ripening, wilting and drying. Grayish black spherical sclerotia develop on the surface or in the pith. The presence of sclerotia inside the bleached tissues helped confirm *S. sclerotiorum*. At the time of harvesting and threshing

sclerotia of the fungus get mixed with seed and this represents as an objectionable seed contaminants for the export. The explosive Pathogenicity of the fungus under favourable conditions and capacity of its sclerotia to survive for several years made it very difficult to guard the rapeseed-mustard from its infection. The sclerotia survive with seed as a contaminant as well as soil-borne pathogen and provide primary inoculum in the following years. Cultural practices and fungicidal control are not effective because of soil borne nature and wide host range of the pathogen. Due to this disease, farmers are facing heavy monetary losses and are therefore, discouraged to take this crop for cultivation in their fields. To avoid this, intensive surveillance of crop is needed to pinpoint the prevalence and loss.

The disease can be better managed by IPM intervention *i.e.* combination of improved cultural practices and biocontrol measures. The NCIPM has taken multilocal field validation trials on large scale on farmers' fields in

Haryana and Rajasthan during Rabi (winter) crop season 2011-12. Multilocational field validation of bio-intensive integrated management practices along with farmers' practices (FP) was conducted in larger area (40 hectare) at cultivators' fields in Mewat and Mahendergarh districts of South western Haryana in collaboration with two KVKs (of CCS, HAU) Mewat and Mahendergarh, and in Alwar district in collaboration with ARS (SKRAU), Navgaon. In these validation trials, an area 12 hectare in Alwar, 12 hectare in Mewat and 16 hectare in Mahendergarh regions was undertaken. Bio-intensive IPM interventions include improved cultural practices such as burying

or burning of diseased crop residue, deep summer ploughing, crop rotation with non host crops, use of clean and sclerotia free certified seed, timely sowing of mustard (between Oct. 16-31), recommended dose of fertilizers @ N: P: K: S-60: 40: 40: 40 kg/ha, maintenance of optimum plant spacing, need based use of irrigation and rouging out of infected plants. IPM intervention also includes soil incorporation of talcum based *Trichoderma harzianum* (2×10^6 c.f.u./g) product @ 2.5 kg per hectare, pre-incubated in 50 kg of farm yard manure (FYM) followed by seed treatment with *T. harzianum* product @ 10g/kg seed and need based foliar spray (1-2) of *T.*

harzianum product @ 0.2 per cent soon after disease appearance at 20 days intervals. At all the three locations, bio-intensive IPM intervention was found decreasing effect on the *Sclerotinia* stem rot and increasing effect on seed yield. Increased cost-benefit ratio resulted in better monetary returns to the farmers in IPM intervention adopted practices as compared to FP. It is concluded that bio-intensive *T. harzianum* based IPM intervention demonstrated lower incidence of *Sclerotinia* rot and better seed yield. IPM intervention can be of great importance to the farmers for managing the disease in better way which is not only cost effective but also environmentally safe.

Meetings / Events

Silver Jubilee Foundation Day

NCIPM celebrated its Silver Jubilee Foundation day on 13 February, 2012 at its upcoming campus at Mehrauli, New Delhi. Dr. S.K. Datta, DDG (CS) was the chief guest. Dr. T.P. Rajendran, ADG(PP), Dr. T.P. Trivedi, ADG(ARIS), Dr. D.K. Arora, Director NBAIM, Dr. O.M. Bambawale, Director NCIPM, officials of CPWD and staff of NCIPM participated in it.

RAC meeting

RAC meeting under the chairmanship of Dr. G.C. Tewari, Vice Chancellor CSAUA&T, Kanpur was held on 24-25th March, 2011 at NCIPM in which the research programmes of the



Foundation day

institute were discussed and evaluated in the light of XII five year plan and recommendations were made regarding the further improvement of programmes of NCIPM.

Institute Research Committee (IRC)

The Institute Research Committee (IRC) was held on 9-10th May, 2011 under the Chairmanship of Dr. O.M. Bambawale, Director, NCIPM. Dr. T.P. Rajendran, ADG



RAC Meeting

(PP) also attended the meeting and contributed his valuable suggestions. The ongoing research programmes of the Centre were reviewed and evaluated along with Action Taken Report of last IRC.

Institute Management Committee Meeting (IMC)

Centre held its IMC meeting under the chairmanship of Director NCIPM on 9 February, 2012.

Research Highlights

Location specific prediction rules for forewarning crop pests

Prediction of cotton sap feeders at Central India

Jassids: Weather based criteria viz., mean temperature of 25-28°C, mean humidity of 65-85%, total rainfall of 50-80 mm and rainy days between 2 and 4 days of any standard meteorological week predict the severity levels based on mean jassid population per three leaves were categorized as to high (>8), moderate (>4-8) and low (<4). All four, three and two or less of the formulated weather criteria being satisfied predict high, moderate and low levels of jassid severity, respectively.

Mirids: Fulfilling e⁵, four and d³ of the six weather based criteria viz., maximum temperature >31°C, minimum temperature between 21 & 24°C, relative humidity (morning) >85%, relative humidity evening between 30-70%, rainfall <25 mm and rainy days between 2 and 4 days on weekly basis predict the severity of mirids (*Campylomma livida* Reuter) on Bt cotton as to high (>4 nos/plant), moderate (>2-4 nos/plant) and low (0-2 nos/plant), respectively.

Thrips: Mean temperature of 25-29°C, mean humidity of 67-86%, total rainfall of 30-80 mm and rainy days between 3 and 6 days of any standard meteorological week predict the levels of severity of thrips in conjunction with severity levels categorized based on mean thrips

population per three leaves as to high (>10), moderate (>5-10) and low (<5). All four, three and two or less of the formulated four weather criteria being satisfied predict high, moderate and low levels of thrips, respectively.

Prediction of rice yellow stem borer

Location: Raipur (Chhattisgarh)

Criteria : Weather based criteria viz., maximum temperature of 31-34°C, minimum temperature between 22 & 23°C relative humidity (morning) of 89-92%, rainfall 0-10 mm and sunshine hours of 6-9 hr/day predict the severity viz., High (>1000), Moderate (100-1000) and Low (<100) of yellow stem borer (YSB) based on light trap catches on weekly basis.

Rule: More than three, three and less than three out of five weather parameters in the criteria predict high, moderate and low severity of YSB, respectively.

Location: Pattambi (Kerala)

Criteria: Weather based criteria viz., maximum temperature of 31-34.5°C, minimum temperature of 20-21°C, relative humidity (morning) of 85-95 %, relative humidity (evening) of 35-50 %, no rainfall and sunshine hours >8.5 hrs/day predict the severity viz., High (>40), Moderate (20-40) and Low (<200) of yellow stem borer (YSB) based on light trap catches on weekly basis.

Rule: Satisfying all six, five and four or less, out of six weather based criteria predict high, moderate and low severity of YSB,

respectively (Data sets used: 2000-2007).

Location: Aduthurai (Tamil Nadu)

Criteria: Weather based criteria viz., maximum temperature of 30-32°C, minimum temperature of 20-22°C, relative humidity (morning) of 90-93%, total rainfall <10 mm and sun shine hours >8-9 hrs/day predict the severity viz., High (>200), Moderate (100-200) and Low (<100) of yellow stem borer (YSB) based on moth catches in light traps on weekly basis. 8-9 hrs/day predict the severity viz., High (> 200), Moderate (100-200) and Low (<100) of yellow stem borer (YSB) based on moth catches in light traps on weekly basis.

Rule: Satisfying more than three, three and two or less, out of five weather based criteria predict high, moderate and low severity of YSB.

Prediction of rice pests at Raipur (Chhattisgarh)

Gall midge

Criteria: Weather based criteria viz., maximum temperature of 32-34°C, minimum temperature of 19-22°C, total rainfall of <10 mm, relative humidity (morning) of 89-93% and sun shine hours of 7-9 hrs/day predict the severity viz., High (>200), Moderate (100-200) and Low (<100) of gall midge based on catches in light trap on weekly basis.

Rule: Satisfying all five, four and three or less, out of five weather based criteria predict high, moderate and low severity of gall midge, respectively.

Combination of pests (YSB, Gall midge, Green leaf hopper and Case worm)

Criteria: Weather based criteria viz., maximum temperature of 31-34°C, minimum temperature of 20-23°C, total rainfall of <10 mm, relative humidity (morning) of 89-93% and sun shine hours of 8-9 hrs/day predict the severity viz., High (>1000), Moderate (500-1000) and Low (<500) of YSB, Gall midge and Case worm, and High (>2000), Moderate (1000-2000) and Low (<1000) of GLH based on catches in light trap on weekly basis.

Rule: Satisfying four or more, three, and two or less out of five weather based criteria predict high, moderate and low severity of all pests.

Prediction of *Spodoptera litura* on Groundnut at Dharwad (Karnataka)

Criteria : Weather based criteria viz., maximum temperature of 25-28°C, minimum temperature of >19.5°C, relative humidity (morning) of >90%, relative humidity (evening) of 78-83% and rainfall <20 mm predict the severity based on weekly pheromone trap catches viz., High (>400), Moderate (200-400) and Low (<200) of *S. litura*.

Rule: Satisfying all five, four and three or less, out of five weather based criteria predict high, moderate and low severity of *Spodoptera*.

IPM validation in Basmati rice

Validation of IPM in basmati rice is to be continued for consecutive third year at Bambawad (District Gautam Budh

Nagar, Uttar Pradesh) in 300 acre. Two meetings were organized at Bambawad (District Gautam Budh Nagar) in the month of June 2012 to apprise the farmers about the IPM interventions to be carried out in Basmati rice. The meeting was attended by more than 30 farmers from IPM village (Bambawad) and adjoining villages.



Meeting with farmers at Bambawad

Pusa 1121 is the most prominent variety representing 80% in this area. Dhaincha (*Sesbania*) has been grown by 60% farmers for green manuring. During the meeting the farmers were apprised about the importance of certified seed especially Pusa 1121 which is very susceptible to bakanae. All the farmers were advised to treat the seeds with carbendazim (@2gm/kg of seed) for half an hour.

Sclerotinia rot: A Serious Menace to Rapeseed-Mustard Cultivation

Among oilseeds, rapeseed-mustard occupies an area of 6.51 million hectare; yield 7.67 million tons (2011-12) with average productivity of 1179 kg/hectare. Rajasthan ranks first in area whereas Haryana ranks first in productivity of rapeseed-mustard. One of the major concerns among biotic stresses in increasing and stabilizing the yield of rapeseed-mustard is the incidence of diseases which, to a large extent, are responsible for low and

unstable production of these crops and cause yield losses ranging from 10-90 per cent. A number of fungal diseases are known to affect rapeseed-mustard crops. *Sclerotinia* rot of rapeseed-mustard caused by *Sclerotinia sclerotiorum* (Lib.) de Bary has emerged as serious menace to their cultivation, particularly in areas where farmers follow monoculture of rapeseed-mustard. This disease is more prevalent in areas where soil is heavy, relative humidity is comparatively high and prolonged cool temperatures prevail during winters, harmonized with flowering and pod formation stages of crops. *Sclerotinia* rot of rapeseed-mustard has set its foot in Rajasthan state resulting heavy disease incidence (up to 90%) and severe yield losses (up to 60%) in different mustard growing areas. It is emerging as a problem in Haryana state.

Field surveys of 140 randomly selected locations was conducted in February and March, 2012 by NCIPM in important rapeseed-mustard growing villages of Gurgaon, Mahendergarh, Mewat and Rewari districts of South western Haryana and Alwar, Bharatpur, Dausa and Jaipur districts of Rajasthan.

The surveys revealed that *S. sclerotiorum* is serious threat to rapeseed-mustard cultivation in all surveyed districts and at some places alarming situation had been developed. The surveys further revealed the incidence and severity of *Sclerotinia* rot ranging from 1.0- 50.0 per cent and 1.0-4.0 grades, respectively. The mean incidence and average severity of *Sclerotinia* rot in South–West zone of Haryana (86 locations) ranged from

5.0-23.0 per cent and 1.3-3.6 grades, respectively, whereas in Rajasthan (54 locations) these ranged from 4.0-17.5 per cent and 1.3-3.7 grades, respectively. High disease incidence and severity were found at Farukhnagar in Gurgaon, Nuh in Mewat, Kanina in Mahendergarh and Pali in Rewari districts of Haryana. Maximum mean incidence and severity (23% and 3.6 grades) were recorded at Farukhnagar followed by Kanina (18% and 2.9 grades) and Sohana (15% and 3.0 grades) Tehsils of Haryana. The survey shows that *Sclerotinia* rot has become a major constraint in rapeseed - mustard cultivation in Haryana.



Sclerotinia rot on stem

In zone 3b of Rajasthan, mean incidence and average severity of *Sclerotinia* ranged from 4.0 – 17.5 per cent and 1.3 – 3.7 grades, respectively. High disease incidence and severity were found at Mandawar (Siyali Khurd), Kishangarh (Kishangarh Bas), Tijara (Baliyawas) and Bahrar (Jhareda) Tehsils of Alwar district and Mahawa (Nagalmeeena) Tehsil in Dausa district. Maximum mean incidence (17.5%) was recorded at Mandawar and Kishangarh followed by Bahrar (15%), whereas maximum average severity grade was in Bahrar (3.7) followed by Kishangarh (3.5) Tehsils. The severity shows *Sclerotinia* rot is now established disease in Zone 3b of Rajasthan.

Sclerotinia rot of rapeseed-mustard has a wide host range. It also causes considerable damage in pea, chickpea, cauliflower, cabbage, sunflower, field beans, carrot and lettuce. Being a polyphagous pathogen, the disease once introduced in the field is difficult to get eradicate. The disease can be better managed by combination of



Farmer showing *Sclerotinia* rot affected plant

improved cultural practices and biocontrol measures i.e. through integrated pest management intervention. The Centre has recently taken up a project exclusively on this disease on rapeseed - mustard for validation in wider areas approximately 40 hectare in Haryana and Rajasthan.

IPM in Bell Pepper

A 'Kisan Goshthi' was organized on 'Integrated Pest Management in Bell Pepper' at the adopted IPM villages Block 'Daha Jagir – Bajidan Jattan-Madanpur-Sirsi' District Karnal, Haryana on 16th January, 2012 under National Horticulture Board (NHB) Project 'Demonstration, Promotion and Popularization of IPM in bell pepper and tomato' with a view to bring awareness among vegetable growers as well for Demonstration, promotion and popularization of IPM technology in the bell pepper crop which is grown in about more than 125 acre

area in these villages. During 2011-12, several new bell pepper growers were added to the IPM programme and were given demonstration about the *Trichoderma* mixing, installation of pheromone traps, changing of lures and spray of *HaNPV* etc. The emphasis was again given on the use of safe and bio pesticides and avoidance of injudicious use of hazardous chemicals. As the IPM programme had already been going on in Daha village, growers were informed about its sustainability and continuity without our material support. The Goshthi was attended by more than seventy farmers from Daha Jagir, Bajindan Jattan, Madanpur & other neighboring villages, scientists from NCIPM and officials from Excels Crop Care India Ltd. interacted with the farmers and apprised them about the important components of IPM programme. Dr. H.R. Sardana, NCIPM briefed about the IPM technology which proved to be a huge success in the last four years and resulted in the management of pests with low input of chemical pesticides and substantial increase in yields. He further said that IPM will have larger and more tangible impact only when more and more area is brought under IPM. Therefore, in this season of 2011-12 about more than 125 acres area covering almost entire Block comprising of villages of Daha, Bajindan, Madanpur, Sirsi



Kisan Goshthi

etc. has been taken for IPM validation and popularization of IPM technology. Other scientists from NCIPM Dr. M.N. Bhatt and Dr. Mukesh Sehgal also addressed the farmers and educated them about the importance of diseases management in bell pepper with the minimum use of chemical

pesticides. The focal point was the raising of healthy nursery and need based application of safer pesticides. The lead IPM farmer, Mr. Gurbachan Singh narrated about the use of polythene mulching in minimizing weeds and disease incidence and the success of IPM in his bell pepper fields and he even raised bell

pepper organically without using any pesticides or fertilizer. During the last three years of IPM demonstration, collar & stem rot of bell pepper has been effectively managed by the use of *Trichoderma* in nurseries and application of Safe fungicide a day before transplanting with restricted irrigation.

National Information System for Pest Management (NISPM)

The project on National Information System for Pest Management in Bt Cotton, originally approved 2008-12 by Directorate of Cotton Development, Ministry of Agriculture, GOI has

been extended for one more year *i.e.* 2012-13. Selection of villages and fields for recording insect pests and diseases in Bt cotton has been completed by all the 13 field centres. At each centre 20 villages were

selected including 10 new villages. In each village two fixed and two random fields were selected. Selection of five IPM farmers in each village has also been carried out by all 13 field centres.

Technology Developed

Real Time Pest Surveillance System for Pest Dynamic Studies

Under NICRA programme, assessment of the changing pest scenarios, mapping of vulnerable regions of pest risks, and evolving curative and preventive pest management strategies towards climatic stress have been emphasized among many approaches to study the impact of climate change on pests. Since pests are biotic natural resources of the Earth, their interdependent interactions amongst system variables are equally influenced by the factors of climate change. Capturing of direct and indirect effects of climate change is crucial for adapting our pest management strategies. Use of historical crop, climate, and pest/disease and management data *vis-a-vis* current conditions provide ample and immediate scope of

understanding effects of climate change and plan for adaptive IPM strategies.

Among many approaches to study impact of climate change on pests, the long term trend analysis of their association with climate is important. Most often the available historical datasets lack quality and continuity and their holistic retrieval is cumbersome. Hence it was essential to devise a plan to gather weather and real time pest surveillance data from experimental stations and farmers' fields and to develop a system for data management. To streamline methods of pest surveillance through carefully designed data recording formats relating to crops, pests, and production and protection practices in addition to weather, elaborate preparations were made so as to improve the efficiency of the activity. Preparation included pest scouts

training, field selection, sampling plan and material required such as data books, set of guidelines, electronic devices, and software etc.

Before starting scouting, a well thought sampling plan was prepared which included crop distribution in the area, field selection, field size, route through the field, selection of spots in the field and finally the number of plants to be surveyed from different spots. The consultative group meeting of identified experts of five crops finalized the structure of pest surveillance to be carried out in selected nursery and fields from the research/experimental stations and farmers' fields from village. The sample plan is the procedure to draw a sample to estimate the population of different pests or the crop damage. A pest scout also had the access to published information and portable handouts on guidelines for crop

pest surveillance. Completely randomized plan was chosen for pest surveillance so that each spot in a field has equal chance of scouting. The scouts were educated about the identification of pests and their sampling plan and its execution. A well thought time schedule and frequency plan was decided for taking pest observations considering pest biology and crop growth. Informations such as crop variety, agronomic practices, pesticide applied etc. were also recorded. Under the programme, thirty six centers from 12 states representing 11 agro climatic zones and 11 agro ecological zones across the country were identified for implementing real time pest surveillance system for five target crops viz. rice, pigeonpea, groundnut, tomato and mango.

For efficient pest and weather data management, a web based system was developed by integrating all the project partners. As the Information technology (IT) has become a very powerful tool to quickly capture, transfer, and report and analyses the information, therefore, application of IT made it possible to store information in a centralized database with ease, in turn making scientific analyses and inferences more meaningful. The system consisted of four major components viz. centralized

NICRA Website

database; offline client data capture application; admin panel; data reporting and analysis application. Centralized database was designed and developed using using SQL server 2008 which consists various related tables for information storage. Client application captures the pest, weather and other relevant information gathered by scouts from fields and compiles them into a folder in the form of XML files. It has in built provision for data validation, viewing and correction. Through admin panel, system administrators manage the

database and track various system activities. Setup files for client software installation by RTPS centers were also generated using admin panel configuring software applicable for the target surveillance center. Scientific staff of the project accesses the database through reporting and analysis module, which generate various kind of pest, weather and pest-weather reports in different formats viz. tabular, graphical and maps. The system is available on NCIPM website at <http://www.ncipm.org.in/nicra/>.

Awards

Shri Ashok Kumar Kanojia awarded with “Young Scientist Associate Award 2012” for specialized research work in the ‘Application of Geospatial Technology in Crop Pest Monitoring’ in the 14 Indian Agricultural Scientists & Framers Congress.

Patents

Dr. Surender kumar Singh and Dr. O.M. Bambawale filed a patent (Application No.: PCT / IB2012 / 050168) for Light trap managing insects with International Bureau of the World Intellectual Property Organization on 13 January 2012.

Visit abroad

Dr. R.V. Singh, participated in fellowship on integrated pest management at The Egyptian International Centre for Agriculture, Cairo, Egypt assigned by DARE, ICAR, Govt. of India from January 14-March 31, 2012.

Trainings organized

Trainings	Date
Training on Client Software towards validation of reporting system to RAs, SRFs, Pest Scouts and Data Entry Operators of NCIPM under NICRA	25 May, 2012
Training and Workshop on Real Time Pest Surveillance (Crops: Pigeonpea & Groundnut) under NICRA	15 & 16 Mar, 2012
Training and Workshop on Real Time Pest Surveillance (Crops: Rice and Tomato) under NICRA	20 & 21 Jan, 2012

Transfer	Obituary
Sh. S. Sathya Kumar, T5 transferred to CICR Regional Station, Coimbatore on 7 April 2012.	Sh. Vikram Singh, Supporting staff expired on 27 January, 2012.
Sh. Vikram Singh, Supporting staff expired on 27 January, 2012.	Sh. Vikram Singh, Supporting staff expired on 27 January, 2012.

हिन्दी गतिविधियां

केन्द्र में राजभाषा हिन्दी को विभागीय कार्यों में प्रोत्साहन देने एवं कर्मचारियों को हिन्दी में कार्य करने में आने वाली कठिनाईयों के निराकरण करने के उद्देश्य से **कम्प्यूटर तथा आधुनिक हिन्दी व्याकरण** पर दिनांक 27/06/2012 को प्रशिक्षण कक्ष में कार्यशाला का आयोजन किया गया। इस बैठक की अध्यक्षता राजभाषा कार्यान्वयन समिति के

अध्यक्ष एवं निदेशक, डॉ. ओ. एम. बम्बावाले के द्वारा की गई तथा संचालन डा. आर वी. सिंह, प्रभारी, हिन्दी प्रकोष्ठ द्वारा किया गया। इस कार्यशाला के प्रमुख वक्ता एवं अनुदेशक के रूप में डॉ. विक्रम सिंह, उपनिदेशक, राजभाषा विभाग, गृह मंत्रालय, नई दिल्ली को आमंत्रित किया गया। डॉ. विक्रम सिंह द्वारा विभागीय कार्यों में हिन्दी के प्रयोग से संबंधित विविधा जानकारी विस्तार से प्रस्तुत की। साथ ही हिन्दी की व्याकरण

सम्बन्धी होने वाली गलतियों से बचने की विधि का भी उल्लेख किया। कार्यशाला में सहभागियों द्वारा व्याकरण पर विविध तरह के प्रश्नों तथा शंकाओं के समाधान हेतु डॉ. विक्रम सिंह द्वारा बहुत अच्छी तरह से समझाया गया। हिन्दी में कार्य करते समय हिन्दी भाषा में व्याकरण से सम्बन्धित प्रश्नों का उत्तर भी बड़े ही सहज ढंग से प्रस्तुत किया गया। इस कार्यशाला में केन्द्र के सभी अधिकारियों एवं कर्मचारियों ने भाग लिया।

Editorial Committee : R.K. Tanwar, Vikas Kanwar, Niranjana Singh,
M.S. Yadav
Technical Support : Neelam Mehta

Published by

Dr. Saroj Singh, Director (Acting)
National Centre for Integrated Pest Management
LBS Building, Pusa Campus, New Delhi 110 012
Ph: 011-25843935, 25843936, 25740951, 25843985
Fax: 011-25841472
E-mail: ipmnet@ncipm.org.in
Website: www.ncipm.org.in