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All India Network Project on Rodent Control
Central Arid Zone Research Institute
Jodhpur - 342 003, India

XV Group Meeting of AINP on Rodent Control, held at College of Veterinary Sciences, Assam Agricultural University, Guwahati (January 22-24, 2013)

Dr T.P. Rajendran, ADG(PP) ICAR, New Delhi addressing the delegates

Technical Session in progress

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Rodent borne diseases of public health importance

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Rodents are the class of mammals, which compete with human beings for food and other resources. Rodents destroy more than 42 million tons of food worth more than $ 30 billion worldwide. In addition to loss of food and contamination by urination and defecation they are the potential reservoir and carrier of many disease causing pathogens of human being. In the past century more than 10 million people have died in India due to rodent borne diseases. Rodents can transmit thirty nine diseases, 11 documented and 12 non documented Hanta Virus to humans.

Rodent species of public health importance: In India, there are 128 species of rodents of which 8 are considered to be the zoonotic reservoir of different communicable diseases (Table 1). They are involved in the transmission of a variety of diseases worldwide and serve as Intermediate hosts for parasites that ultimately infect man. The causative organisms of rodent borne diseases belong to various groups of microorganisms viz. virus, rickettisia, bacteria, fungi, protozoa and nematodes. They act as reservoir of disease agents, picked up by arthropod vectors and transmitted to humans through bites. Rodents directly transmit Hanta viruses through inhalation of aerosolized excreta, ingestion of excreta or by direct contact with the rodent itself.

1. Plague: It is a zoonotic disease primarily of rodents caused by the pathogen *Yersinia pestis* (1894). It is a gram negative, non-motile, non-sporing, small, straight, oval shaped bacteria. The insect vectors are *Xenopsylla cheopis*, *X. brasiliensis*, *X. astia* and *Pulex irritans*. The rodent reservoirs are *Tatera indica* and *Bandicota bengalensis* and the susceptible hosts are *Rattus rattus*, *Mus musculus* and *Bandicota indica*. The Wild / Sylvatic plague is existing in nature independent of human population and activities. The domestic plague is intimately associated with the contact between wild and domestic rodents resulting in sporadic cases of human plague and occasional outbreaks.

1.1. Current Plague scenario in the World and India: Among various rodent borne diseases, plague is the important pestilential disease which

Table1. Rodent species and zoonotic diseases transmitted

Rodent Species	Disease transmission
1. *Tatera indica*	Plague/Leptospirosis/Scrub Typhus
2. *Bandicota bengalensis*	Plague/Leptospirosis/Scrub Typhus/other rodent borne diseases
3. *Bandicota indica*	Plague? /Leptospirosis/Salmonella?
4.*Rattus rattus*	Plague/Leptospirosis/Scrub Typhus/other rodent borne diseases
5. *Mus musculus*	Plague/Leptospirosis/other rodent borne diseases
6. *Rattus norvegicus*	Leptospirosis
7. *Meriones hurrianae*	Cutaneous leishmaniasis
8. *Funambulus sp.*	Plague

ravages the world for many centuries. Plague continues to remain endemic in various countries of the world during the period of 2004 to 2009, a total of 12,503 cases of human plague, including 843 deaths, were reported by 16 countries in Asia, Africa and the America. In India last case of human plague of the century was reported from Mulbagal, the tri-junction of Karnataka, Andhra Pradesh and Tamil Nadu in 1966. It re-emerged in the country after a gap of 28 years in 1994 in Beed (Maharashtra) and Surat (Gujarat) resulted in huge economic loss. Later plague outbreaks have been reported in 2002 from Rohru (Himachal Pradesh) and in 2004 from Barkot (Uttarakhand), however these outbreaks were contained successfully due to early diagnosis and prompt intervention. The plague surveillance network of the country is undertaking the routine surveillance in the endemic districts through State Plague Control Unit spreaded in the seven states of the country (Fig. 1).

1.2. Plague Surveillance: The Central Plague Laboratory is located at National Centre for Disease Control (NCDC), Delhi and is coordinating plague surveillance in the country. It maintains state of the art laboratory with diagnostic facilities and maintenance of isolates. The human resource development and outbreak investigation are also carried out. The NCDC Plague surveillance Unit, Bangalore is carrying out bacteriological, serological and entomological surveillance, investigation of rat fall and suspected outbreaks, field based trainings, co-ordination of surveillance activities with state plague control units.

Since plague is a notifiable disease according to International Health Regulations (IHR) 2005 of World Health Organization, surveillance is also being carried out in all the International Seaports of the country.

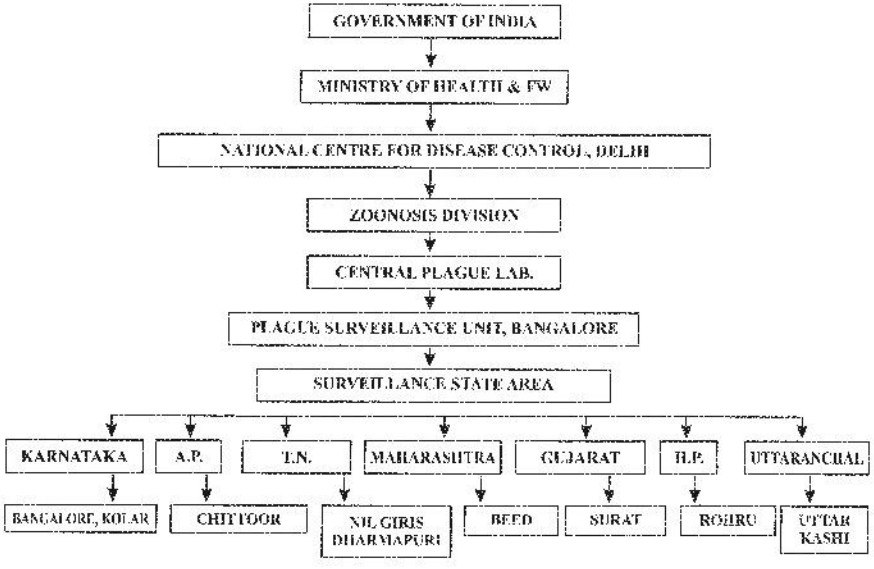

Fig. 1. Plague Surveillance Network

2. Other Rodent borne Diseases: In addition to plague some of the important rodent borne diseases prevalent in India and the World are given below:

2.1. Leptospirosis (Weil's disease): It is another important disease transmitted by the rodents particularly by *Rattus norvegicus*. The infection is acquired through direct contact with the environment contaminated with urine/animal excreta. Man also acquires this disease while engaged with traditional occupations like agriculture and fishing. The entry of the pathogen is through cut and aberration in the skin and through mucous membrane, but no person to person transmission has been reported. The clinical presentation is variable and it simulates many other diseases. It has been reported from many tropical countries and in India mainly from Gujarat, Kerala, Maharashtra and Andaman & Nicobar Islands.

2.2. Scrub Typhus: (Chigger borne typhus, Tsutsugamushi fever, Mite-Borne Rickettsiosis) It is caused by *Rickttsiae tsutsugamushi* and transmitted by Trombiculid mites of the genus *Leptotrombidium*. In nature

the disease pathogen is prevalent in wild rodents, which acts as reservoir and the vector mites acquire the pathogen through bite and responsible for the transmission in human being. First described in Japan and later reported from India, Sri Lanka, Pakistan, Islands of southwest Pacific and coastal Queensland.

2.3. Kyasanur Forest Disease (KFD): It is otherwise called as monkey fever which was first reported from Shimoga district of Karnataka state in 1957 following the deaths of *Presbytis entellus* and *Macaca radiata* monkeys. Rodent is the reservoir of the disease and the pathogen is transmitted by Ixodid ticks, *Haemophysalis spinigera* and *H. turturis*. Human infection associated with wood gathering and cattle grazing in the forest through tick bites.

2.4. Murine Typhus Fever (Flea borne Typhus): It is caused by *Rickettsia typhi* (*R. mooseri*) and the vectors are rat fleas *Xenopsylla cheopis*. The pathogen ingested from the rats, proliferates in the flea's stomach and malphigian tubules and is then excreted along with the faeces. Human infection results due to contamination from dried faeces and crushed bodies of the fleas. Reservoirs are *Rattus rattus*, *R. norvegicus* and *Mus musculus*. It is distributed worldwide and found in areas where people and rats occupy the same buildings.

2.5. Rocky Mountain spotted fever (Tick Borne Typhus): It is caused by *Rickettsia rickettsii* and the reservoirs are wild rodents, dogs and opossums. It has been reported from Brazil, Argentina, Canada, Coloumbia, Costa Rica, Mexico, Panama and USA.

2.6. Relapsing Fever: It is caused by *Borrelia recurrentis* and the mode of transmission is either through Louse (*Pediculus humanus*) or Tick (Argasid ticks). It is geographically distributed in Asia, Ethiopia, Sudan, South America, Spain, Saudi Arabia, Iran, India, Western USA and Canada.

2.8. Salmonellosis: It is a food borne disease caused by Salmonella having numerous serotypes. A wide range of domestic and wild animals including rodents are the reservoirs. Its mode of transmission is by ingestion of the organism in food derived from animals or contaminated by faeces of infected animals. It is globally distributed and extensively reported in North America and Europe.

2.9. Haemorrhagic Fever with Renal Syndrome (Korean Haemorrhagic fever): It is an acute zoonotic viral disease caused by Hanta viruses. The main reservoirs are the Wild rodents (*Apodesmus Spp.* and *Rattus Spp*).

Humans are the accidental host and mode of transmission is by aerosol transmission from rodent excreta. Virus is present in urine, faeces and saliva of persistently infected asymptomatic rodents. Geographic distribution is from South Korea, China, Thailand, USA, Brazil, Argentina and European countries.

2.10. Pulmonary Syndrome: It is also caused by Hanta virus. Its reservoir is Pack Rat or Cotton Rat (*Sigmodon bispidus*) and the mode of transmission is by the inhalation of aerosolized rodent excreta. It is reported worldwide as sporadic and epidemic disease.

(Excerpts of special lecture delivered by senior author during All India Group Meeting of AINP on Rodent Control, Guwahati, January, 22-24, 2013)

Evaluation of hing (*Eosina foetida*) as additive for increasing bait acceptance by lesser bandicoot rat, *Bandicota bengalensis*

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Farmers' feedback regarding the use of hing in 2% zinc phosphide bait to increase the acceptance of poison bait prompted to conduct studies on its evaluation against predominant rodent pest species, the lesser bandicoot rat, *Bandicota bengalensis*. Twelve male and twelve female *B. bengalensis* were live trapped from localities near railway station at Ludhiana. In the laboratory, rats were kept in individual cages for acclimatization for 15 days with food and water provided *ad libitum*. Food was prepared by mixing cracked wheat, powdered sugar and groundnut oil in ratio 96: 2: 2 (WSO). The rats of each sex were weighed and divided into two groups (I and II) of six rats each. Bi-choice test was conducted by providing treated and plain bait. Rats of group I of each sex were provided baits treated with 0.1% hing powder dissolved in groundnut oil, whereas, rats of group II of each sex were provided baits treated with 0.1% hing powder alone. This was done to test by which method the odour of the hing lasts longer in bait. Before and after treatment all the rats were fed on WSO alone. Consumption of food was recorded after every 24 hour. Mean daily intake (g/100g bw) of food for pre-treatment, during treatment and post-treatment periods was calculated. Results are presented in Table 1.

The consumption of bait in both the treatment (bait treated with 0.1% hing powder alone and 0.1% hing powder mixed in groundnut oil) was significant in male *B. bengalensis* ($p=0.05$), whereas it was non significant in females. Similarly the bait consumption was non-significant between the sexes in both the treatment. Also there was no significant difference in consumption of bait during pre and post-treatment periods. Present results thus revealed no effect of 0.1% hing powder in improving the bait acceptance by both the sexes of *B. bengalensis*.

Table 1. Acceptance of bait containing 0.1% hing powder by *B. bengalensis* under laboratory conditions

Sex	Group	Body wt. (g) (n = 6 each)	Treatment	Mean daily food consumption (g/100g bw)			
				Pre-treatment	Treatment		Post-treatment
					Plain bait	Treated bait	
Male	I	189.17± 27.50	0.1% hing powder dissolved in groundnut oil	10.76±0.27	8.11±0.65	5.31±0.24*	10.24±0.17
	II	186.67± 21.56	0.1% hing powder alone	10.37±0.16	7.32±0.27	5.18±0.63*	10.28±0.34
Female	I	210.83± 16.00	0.1% hing powder dissolved in groundnut oil	9.68±0.36	6.64±0.45	6.07±0.33	9.50±0.17
	II	217.50± 15.17	0.1% hing powder alone	9.26±0.28	6.01±0.41	6.01± 0.73	9.09±0.21

*Values are Mean ± SE, n = no. of rats, *significantly low consumption of treated bait*

Field efficacy of Ecodon - A plant based repellent against rodents in rice

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Rodents are one of the important biotic factors responsible for enormous losses to standing crops resulting in reduction in crop yields. Our recent studies have revealed 6.72 and 7.56% yield loss in rice due to rodent depredations, respectively in Mandya and Malnad regions of

Karnataka. Though, a number of acute (zinc phosphide) and chronic (bromodiolone and brodifacoum) rodenticides have been evaluated, yet need for a novel compound which can manage rodents effectively in an ecofriendly manner and also prevent new immigrations is the demand of time. Hence, a new product Ecodon (castor based rodent repellent) manufactured and supplied by M/s Higrow Floris Chemicals Pvt Ltd, Hyderabad was evaluated for its efficacy against field rodents in rice at Zonal Agricultural Research Station, Mandya, Karnataka during Kharif 2010. The Ecodon @ 10ml/l of water was sprayed on bunds during tillering stage in evening hours. Before treatment the bunds were made weed free and made moist by spraying water.

Observations on live burrow count (LBC/ha) and tiller damage before treatment and on 1st, 3rd, 5th and 7th weeks after treatment was recorded. The results indicated that the rodent population reduced to 64.52 and 65.99 per cent as assessed respectively, by LBC and tiller damage after one week of treatment. The reduction in rodent population continued upto 3rd week when population reduction of 75.04 and 74.62 per cent was assessed respectively, by LBC and tiller damage. From 5th week onwards the control success started declining, since an increasing trend in the population of rodents registered (Table 1). The study therefore indicated that the Ecodon spray may be effective as rodent repellent for 3-5 weeks.

Table 1: Effect of Ecodon spray on the rodent population and incidence in paddy field

Treatment	Live burrow count (LBC) /ha					Tiller damage (%)				
	1 DBT	1WAT	3WAT	5WAT	7WAT	1 DBT	1WAT	3WAT	5WAT	7WAT
Ecodon (@ 10ml/l of water)	60	23	17	25	31	5.92	2.07	1.59	1.83	2.42
Control	62	67	72	74	70	6.06	6.23	6.41	6.70	6.29
Reduction over control (%)	-	64.52	75.04	71.68	45.76	-	65.99	74.62	72.03	62.27

Note: DBT= Day before treatment WAT= Weeks after treatment

Evaluation of various Integrated Rodent Management modules in irrigated rice ecosystem

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Rodents are one of the major biotic constraints of paddy. The rodents attack rice plants throughout their growth periods i.e., from seedling to harvesting. However, the attack intensifies during maximum tillering, when the rice canopy becomes dense. Field experiments were carried out to evaluate the efficacy of seven different integrated rodent management modules (M1-Cultural practices + zinc phosphide poison baiting + bromadiolone poison baiting, M2- Cultural practices + bromadiolone poison baiting, M3- Cultural practices + bromodiolone poison baiting + burrow fumigation, M4- Cultural practices + bromadiolone poison baiting + aluminium phosphide tablets usage, M5-Cultural practices + trapping + ecodon+ burrow fumigation, M6- Farmers practices and M7- Control) against rodent pests in irrigated rice ecosystem. The trials were conducted at Lankalakoderu village of Palakol Mandal, West Godavari district in rice-rice-fallow/pulses cropping system for kharif and rabi seasons of 2011-12. An area of about 30 ha having fairly good infestation of rodent pests with no previous record of rodenticides treatment for at least one season was selected. The study sites (30 ha) were divided into three blocks following randomized block design (RBD). Each block (10 ha) represents one replication and consisted of seven plots of 1 ha area for each treatment with a border area of 0.40-0.45 ha between the plots. The efficacy of modules was assessed in terms of per cent reduction in the rodent population and their damage incidence over control by live burrow count and per cent cut tillers methods, simultaneously before and after imposition of treatments at tillering, panicle initiation and harvesting stages of the rice crop. The data on percent rodent control success for each module at all the above said stages of the crop were worked out. All the modules were significantly superior over control in reducing the rodent population and their damage. However, the module M3 consisting of cultural practices, burrow fumigation and poison baiting with the rodenticide bromadiolone

was the most effective integrated rodent management module at all the stages of the crop growth resulting in 86.5 & 80.3% control of rodent population and 83.4 & 80.9% reduction in damage incidence with a higher benefit cost ratio of 26:1 & 30:1 in kharif and rabi seasons, respectively. The non chemical and eco friendly module M5 (cultural practices + trapping + Ecodon + burrow fumigation) was also proven to be superior next to M3 in order of efficacy against rodent pests. Therefore, it is concluded that all the integrated rodent management modules tested in the field trial were effective for management of rodents in irrigated rice ecosystem and among all the seven modules tested the M3 and M5 modules were proven to be superior with highest control success. (Courtesy: Abstracts book of International Conference on "Plant Health Management and Food Security" Hyderabad, Nov 27-30, 2012. Pp:51-52).

Fifteenth Group Meeting: AINP on Rodent Control
(January 22-24, 2013)

The Fifteenth Group Meeting of All India Network Project on Rodent was organized under the aegis of ICAR, New Delhi at College of Veterinary Sciences, Assam Agricultural University, Guwahati from January 22-24, 2013. During the inaugural session Dr. R.N. Goswami, Dean, College of Veterinary Sciences and Chairman of the Organizing Committee welcomed the guests and delegates and briefed about significance of rodent control in agriculture and public health. Dr T. P Rajendran, ADG (PP), ICAR, New Delhi graced the function as Chief Guest and Dr G.N. Hazarika, Director (Research), AAU, Jorhat and Mr B. Kabindra, Director Agriculture (Govt of Assam) were the Guests of honour. Dr R. S. Tripathi, Network Coordinator, AINP on Rodent Control, CAZRI, Jodhpur presented the Progress Report of the Project for the period 2010-12. Dr Hazarika, in his address thanked ICAR for selecting AAU as the venue of this important Group Meeting dealing with two important groups of vertebrates (rodents and birds) affecting the agricultural production of the state. He said that rodents and NE India are closely associated, particularly during bamboo flowering periods when rodents cause immense losses to crops and granaries. He informed that Jorhat center has generated very useful information on rodents of this region and has attempted to evolve region specific management technologies. Mr Kabindra, Director of Agriculture, Assam expressed the need for rodent management especially in rice and

vegetables and informed that his department is working very closely with rodent researchers of the University for transfer of rodent management technologies. He said that capacity building on rodent control would be strengthened in collaboration with rodent scientists of the University.

Dr. T.P. Rajendran, ADG (PP), ICAR in his address expressed satisfaction that AINP on Rodent Control have made significant marks. He outlined some important researchable issues on the subject and appreciated the social engineering activity undertaken by the Project which has proved highly effective outreach programme in transfer of technologies at grass root levels. He appealed to the rodenticide Industry to join hands with scientists in capacity building and transfer of rodent management technologies to the end users.

During the different technical sessions the work done by the different cooperating centers, self-funded centers, State Agricultural Departments, rodenticide Industries etc. were deliberated at length. A special Lecture Series was planned in a special session where lectures on (i) Rodent borne diseases and their surveillance in India (by Dr N. Balakrishnan, Jt Director, Plague Surveillance Unit, National Center of Disease Control, Bangalore) (ii) Rodent parasitology (by Dr Neena Singla, Associate Professor, Zoology, PAU, Ludhiana) and (iii) Emerging Infectious Diseases (by Dr Abhay Chowdhury, Director, Haffkine Institute for Training, Research and Testing, Mumbai) were delivered.

Future programmes to be taken up both multi locational and location specific for the next biennium were formulated and the recommendations in regard to rodent management for the farmers of different agro-climatic zones were finalized. In his concluding remarks, Dr. Rajendran reiterated that, besides, serious rodent menace in agriculture and storage, rodent borne public and animal diseases are also increasing and therefore needs immediate attention of medical and veterinary researchers. AINP on Rodent Control may be helpful in providing information on eco-biology and management options of rodent vectors. He opined that besides introduction of new safer molecules of anticoagulants, studies on non-lethal methods of rodent management need to be strengthened further.

In a special session, the participants felicitated Dr. T. P. Rajendran, ADG (PP), ICAR, New Delhi and Dr. A.M.K. Mohan Rao, Former Jt Director, (VPM), NIPHM, Hyderabad and expressed sincere gratitude to both the stalwarts for providing guidance, support and blessings in furthering research on rodents and birds during last many years.

National Trainings on Rodent Pest Management

1. ANDHRA PRADESH (FEBRUARY 20-26, 2013)

A seven-day National Training on 'Rodent Pest Management' was jointly organized by AINP on Rodent Control and National Institute of Plant Health Management (NIPHM), Hyderabad at A.P. Rice Research Institute (APRRI) and Regional Agricultural Research Station (RARS), ANG Ranga Agricultural University (ANGRAU) Maruteru (West Godawari Distt, A.P.) from 20th-26th February, 2013. Twenty Extension functionaries from states of Odisha and Andhra Pradesh representing Department of Agriculture, Farmers Training Centres, Krishi Vigyan Kendras attended this course. The programme was inaugurated by Dr. M. Bharatha Lakshmi, Associate Director of Research, APRRI & RARS, and Sri V.D.V. Krupadas, Joint Director of Agriculture, West Godavari District. Dr. Ch. V. Narasimha Rao, Senior Scientist & P.I. AINP on Rodent Control outlined the objectives of the training programme. Dr. Bharatha Lakshmi, in her opening remarks narrated the rodent pest scenario in India and explained the importance of training programme to the participants. Sri Krupadas, enumerated the crop losses due to rodent pest in Godavari delta areas and narrated the success stories of rodent control campaigns in West Godavari District. A Training manual on 'Rodent Pest Management' prepared by Rodent scientists of Maruteru was released on this occasion. A pre-evaluation test was conducted to assess the knowledge of the participants.

The training was conducted in interactive mode with theory lectures, practicals and field exposure visits. The resource persons included: Dr A.M.K. Mohan Rao, Jt Director (Retd), NIPHM, Hyderabad; Dr R.S. Tripathi, Network Coordinator, AINP on Rodent Control, CAZRI, Jodhpur, Dr. M. Zaheeruddinn, ADR (Retd), ANGRAU, Maruteru; Dr V. Deva Prasad, Professor (Entomology), ANGRAU, Baptla; Dr N. Srinivasa Rao, AD (VPM), NIPHM, Hyderabad and Dr Ch.V. Narsimha Rao, PI (Rodent Control), Dr. D. Sudha Rani, Scientist (Rodent Control) and Dr K. Vasantha Bhanu, Scientist (Entomology) APPRI & RARS (ANGRAU), Maruteru. The experts delivered theory lectures on various topics viz., Major rodent species and their diagnosis, Biology and Breeding patterns of Rodents, Rodent Population estimation and Damage assessment, Rodent Pest Management in Paddy; Rodent pest problems in Plantation crops and their management; Rodenticide Application techniques; Inspection and control techniques of rodent infestation in storage structures; Community mapping for rodent

management; Recent trends in Rodent Pest Management; Rodent Campaign Evaluation by Supervisory Officers and Role of rodents in Public health. Participants were explained about technical and administrative guidelines for developing action plan for organizing the anti-rodent campaigns.

Besides theory lectures, laboratory practicals on identification of pest species and dissections of pregnant and lactating bandiccots were performed. The trainees were taken to fields for exercises on identification of live burrows of *Bandicota bengalensis* and *Mus booduga*, rodent Population estimation and damage assessment in rice. Participants were exposed to the rodent pest management technologies adopted at APRRI research farm. Demonstration on rodenticide baiting technologies was also arranged in the field. Visit to Horticultural Research Station, Ambajipeta was conducted for field exercises on damage assessment in plantation crops, working out KAP analysis and developing rodent seasonal calendar. The participants interacted with local farmers regarding rodent pests problem and adoption of integrated management practices. On last day the participants were exposed to community based anti-rodent campaign organized by State Agriculture Department in a nearby village. A post-evaluation test was conducted after completion of seven day training programme.

The valedictory Session was presided over by Dr. M. Bharatha Lakshmi, and Sri V.D.V. Krupadas; Dr. R.S. Tripathi, Dr. A.M.K. Mohan Rao and Dr. N. Srinivasa Rao were the Guests of honour. After receiving the feedback from the participants, the guests appealed to the participants to extend the knowledge gained during this trainers' training programme to their departmental functionaries so that technologies reach to the farmers in more effective manner. The participation Certificates were distributed to the trainees by the dignitaries. On this occasion a technical bulletin entitled 'Rodent Pest problems and their Management in Rice' was also released. The valedictory session concluded with vote of thanks proposed by Dr. Ch. V. Narasimha Rao. (Input by: Dr Ch.V. Narsimha Rao, Principal Investigator, AINP on Rodent Control, APRRI & RARS (ANGRAU), Maruteru-534 122 (A.P.)

2. PUNJAB (APRIL 16-22, 2013)

National Training Programme on "Rodent Pest Management," was organized by the Department of Zoology, Punjab Agricultural University,

Ludhiana center of AINP on Rodent Control in collaboration with National Institute of Plant Health Management (NIPHM), Hyderabad from 16th to 22nd April, 2013. The training was attended by officials from Departments of Agriculture, Horticulture and Soil Conservation representing states of Punjab, Haryana and Himachal Pradesh.

The Programme was inaugurated by Dr. M.S. Gill, Director of Extension Education, PAU, Ludhiana in august presence of Dr. R.S. Tripathi, Project Coordinator, AINP on Rodent Control and Dr. J.S. Dhiman, Additional Director of Research (Natural Resource and Plant Health Management), and Dr. G.K. Sangha, Course Director and Head, Deptt of Zoology, PAU, Ludhiana. Dr. Tripathi informed that 'National Plan on Rodent Pest Management' initiated by Department of Agriculture and Cooperation, Ministry of Agriculture (GOI) has laid greater emphasis on capacity building activities to create a nucleus of trained manpower on Rodent pest management in different states. AINP on Rodent Control is providing technical support to this Plan. He hoped that the trainees from three northern states would be immensely benefitted from this training and would act as master trainers in their states. Expressing happiness, chief guest Dr. Gill highlighted the problem of rodents in agriculture and storage and said that this training programme will enhance the knowledge of the trainees about the rodent pest management. Dr. Dhiman, emphasized the need of transferring the rodent management technologies developed by PAU, Ludhiana to the farmers through such capacity building programmes. A publication entitled "Recent Advances in Rodent Research in Punjab" was also released on this occasion.

The experts from All India Network Project (AINP) on Rodent Control, viz., Dr. R.S. Tripathi, Project Coordinator, CAZRI, Jodhpur; Dr. D.K. Bora, Assam Agricultural University, Jorhat; Dr. Neena Singla, Dr. B.K. Babbar and Dr. Rajwinder Singh, Dr. D.K. Kocher and Dr. Tejdeep Kaur, PAU, Ludhiana and Dr. N. Srinivasa Rao, NIPHM, Hyderabad delivered lectures on different aspects of ecology, biology, behavior, damage and management of rodent pests in different situations. During this seven day programme, 14 lectures and 10 laboratory and field demonstrations were arranged.

The participants were exposed to crop fields in PAU campus and four villages of Ludhiana District for rodent damage appraisal in various crops, poultry farms and post-harvest storage. During the training, participants were demonstrated about various techniques of rodent population estimations viz., track marking, bait census, live burrow census

and trapping. They were also apprised of poly/net house cultivation and methods of rodent proofing in such structures. Demonstration was given on methods of poison bait preparation and its application in fresh burrows of *Bandicota bengalensis*. Burrowing and hoarding behavior of *B. bengalensis* was practically demonstrated and food hoardings were recorded. Chemical methods of rodent control, advantages and disadvantages of different rodenticides, methods of rodenticide bait preparation and application, timings of rodent control and safety precautions were explained through theory lectures and practicals. Other methods of control like, mechanical (use of different types of traps), burrow fumigation, use of repellents, predatory cues, pheromones, sterilants and biological control etc were explained in light of their integration with chemical control methods. Besides, importance of organizing village level anti rat campaigns, technical guidance on preparation of proposals related to 'rodent management in endemic areas' for funding by Ministry of Agriculture, Govt. of India was provided. Role of rodents in transmitting various diseases to man and animals such as plague and leptospirosis was also discussed. Impact of training programme was assessed through structured schedule.

During the valedictory function, Dr. R.S. Sidhu, Dean, College of Basic Sciences and Humanities, PAU, Ludhiana appreciated the present training module and said that this training will be of immense benefit to the participants, who play an important role in the transferring these farm technologies to the farmers at grass root level. Dr. H.S. Sehgal, Additional Director of Communication, PAU, Ludhiana said that creating awakening about the rodent pest problems and their management is the need of the hour. Dr. Srinivasa Rao, Assistant Director, NIPHM, Hyderabad thanked the organizers for successful organization of the Training and expressed the need for more such trainings. (Input by: Dr. Neena Singla, Principal Investigator, AINP on Rodent Control, Punjab Agricultural University, Ludhiana-141 004, Punjab)

Near-toothless rodent species discovered in Indonesia

A unique species of near-toothless rat that lives off earthworms and doesn't chew or gnaw has been seen in Indonesia. Two rats were found in the mountainous rain forest of southern Sulawesi Island on Mount Latimojong and on Mount Gandangdewata.

The shrew-like animal with a long, pointed snout was described online in British Journal of Biology Letters as *Paucidentomys vermidax* (Fig.1) which translates loosely to "few-toothed rat" and "worm eater," is the only rodent out of more than 2,200 known species that does not have molars and instead has bicuspid upper incisors. Since it lacks cheek teeth, the rat sucks in earthworms and slices them with its incisors before spitting out the pieces and then slurping bites down whole, said the co-author, A. Achmadi from Indonesia's Museum Zoologicum Bogoriense. The researchers said the discovery is important because it shows how rodents, which are known for biting and chewing, were forced to evolve to survive in Sulawesi's environment.

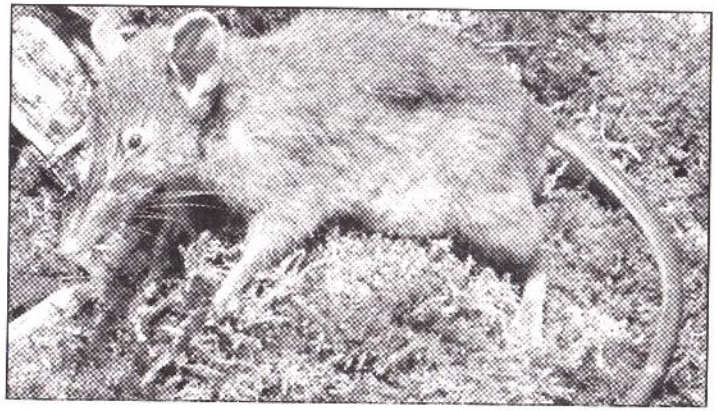
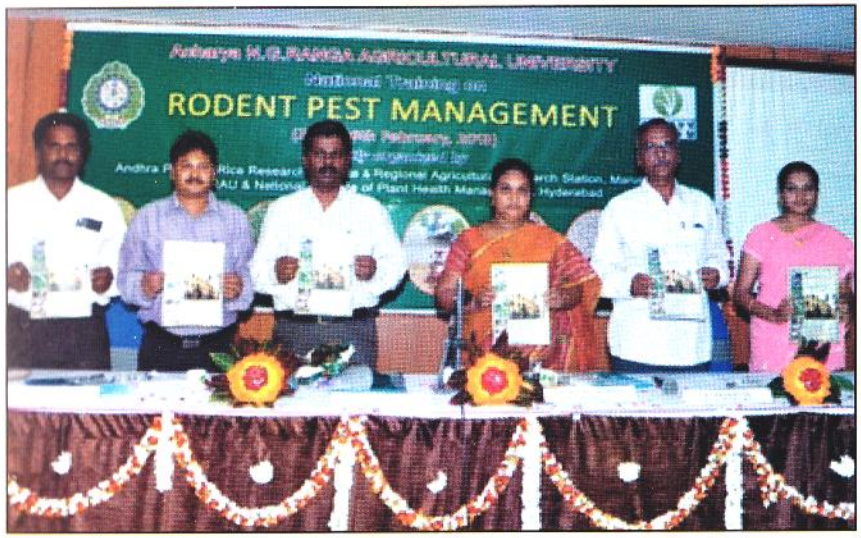


Fig.1. *Paucidentomys vermidax* (Kevin Rowe/Associated Press)

"What defines rodents is their capacity to gnaw with their ever-growing incisors, which are worn down to form chisels," said co-author Kevin Rowe, senior curator of mammals at Museum Victoria in Melbourne, Australia. "It's a remarkable evolution that a trait that's been so successful (and) has allowed rodents to chew into everything from seeds to felling trees to eating our garbage and chewing their way into our house, this species has given up on that capacity in the pursuit of its lifestyle, which appears to include eating earthworms." It has a very long rostrum, small eyes, large ears, a soft pelage and a long bi-coloured tail. (Source: Esselstyn, J.A., Achmadi, A.S. and Rowe, K.C. 2012. Evolutionary novelty in a rat with no molars. Biology Letters, published online, August 22, 2012 and The Associated Press; Posted on line on August 23, 2012)

NATIONAL TRAININGS ON RODENT PEST MANAGEMENT



A.P. R.R.I and R.A.R.S. (ANGRAU), Maruteru (February 22-26, 2013)

Punjab Agricultural University, Ludhiana (April 16-22, 2013)

Contributions for inclusion in the Newsletter may please be forwarded alongwith 1 - 2 good black and white / colour photographs to :

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