


# Proceedings of the Webinar on

# Safe and Effective Use of Non-Toxic Rodent Management Methods for the Control of Rats and Mice in Human Habitations

**National Institute of Agricultural Extension Management (MANAGE)**
(An Autonomous Organization of Ministry of Agriculture & Farmers Welfare, Govt. of India)
Rajendranagar, Hyderabad-500030, Telangana, India
www.manage.gov.in

*Proceedings of the Webinar on*

# Safe and Effective Use of Non-Toxic Rodent Management Methods for the Control of Rats and Mice in Human Habitations


*Edited by:*

**Dr. A.M.K.Mohan Rao**

Member, Vector Control Working Group TCP, Switzerland and
Former Joint Director, Vertebrate Pest Management
National Institute of Plant Health Management, Rajendranagar, Hyderabad

and

**Dr. B. Renuka Rani**

Deputy Director (NRM), MANAGE
National Institute of Agricultural Extension Management (MANAGE),
Hyderabad, India.



**National Institute of Agricultural Extension Management (MANAGE)**

(Ministry of Agriculture and Farmers Welfare, Government of India)
Rajendranagar, Hyderabad, 500030

**Proceedings of the Webinar on Safe and Effective Use of Non-Toxic Rodent Management Methods for the Control of Rats and Mice in Human Habitations**

**Editors:** Dr. A.M.K.Mohan Rao and Dr. B. Renuka Rani

**Edition:** 2021. 

**ISBN:** 978-93-91668-48-8

**Citation:** Mohan Rao, A.M.K and Renuka Rani, B (2021). Proceedings of the Webinar on Safe and Effective Use of Non-Toxic Rodent Management Methods for the Control of Rats and Mice in Human Habitations, [E-book]. Hyderabad: National Institute of Agricultural Extension Management (MANAGE).



This e-book is a compilation of resource text obtained from various subject experts Online Webinar on Safe And Effective Use of Non-Toxic Rodent Management Methods for Control of Rats and Mice Organised On 29 September, 2021, MANAGE, Hyderabad, Telangana. This e-book is designed to educate extension workers, students, and research scholars, academicians related orientation on importance of Safe and Effective Use of Non-Toxic Rodent Management. Neither the publisher nor the contributors, authors and editors assume any liability for any damage or injury to persons or property from any use of methods, instructions, or ideas contained in the e-book. No part of this publication may be reproduced or transmitted without prior permission of the publisher/editor/authors. Publisher and editor do not give warranty for any error or omissions regarding the materials in this e-book.

---

Published for Dr. P. Chandra Shekara, Director General, National Institute of Agricultural Extension Management (MANAGE), Hyderabad, India by Dr. Srinivasacharyulu Attaluri, Program Officer, MANAGE and printed at MANAGE, Hyderabad as e-publication.

**CONTENTS**

## FOREWORD

There is no exaggeration that rats and mice are universally known on earth and these tiny rodents became part of household everywhere. However, they pose problems of nuisance value, loss of stored food grains, and damage to domestic objects and also transmit few major common ailments to residents. As they are well known to everybody, their control is also known universally killing them individually, trapping, using poison baits and off late non-poisonous sticky traps. Whatever method is used, their management is taken casually and serious effort to know the actual result of management is not made. This is also due to a psychological thinking that they are the animals that would coexist with humans.

However, this has led to increase in the rodent related problems along with human population growth. This increased the awareness of their activities and losses inflicted including human disease burden like salmonellosis (food poisoning), allergies, rat bite fever, scrub typhus, leishmania, plague etc. In addition, climate change, global warming with other vector/reservoir species led to more disease burden on globe. A review of the control / management measures of these commensal rodents co existing with humans showed that simple methods those could be effective to bring successful rodent control are being ignored and chemical control is resorted most often leading to more pesticide related residues including plastics in the environment.

This has led to think that sustainable, environmentally safer and cost effective methods could be used to manage the rats and mice in human habitations as well as establishments. The present Webinar was organised for projecting such methods to create awareness for commensal rodent management. Various methods that are in vogue with their efficacy were presented by rodent experts with suggestions for improvement. It is hoped that all clientele groups will take a note and adopt them.

**Dr. Chandra Sekara**
**Director General**

## 1. Background of the Webinar

Rodents established successfully at global level due to their adaptability, globalization and expansion of habitations in agrarian ecosystems. Among them rats and mice have become commensal co-existing with humans sharing the habitat, food etc in all human establishments/habitations. Further, global climate change, slackness and casual way of maintenance of human/industrial corridors, livelihood improvements and casual/indifferent methods adopted for their physical elimination made them to thrive successfully and inflict physical losses to structures, causing quantitative losses to food and commodities and even public health problems to human/farm animal life both in rural and urban areas. Sometimes their population reached plague (outbreak) levels mostly due to an erroneous feeling that rats and mice could be eliminated by using poisons or traps (including sticky traps). The current Australian plague (outbreak) of mice (being called one of the worst plagues in decades) in Australia's eastern states is due to such erroneous impression on their management. Due to increased burden of these commensals and also deleterious impact of poison control measures at global level, one day on-line technical session (webinar) was conducted on *"Safe and effective use of non-toxic rodent management methods for the control of Rats and Mice"* was conducted on 29.9.2021 for all stakeholders. The contact particulars of 150 participants is at Annexure I. Expert presentations on major topics were made in this technical webinar. The schedule is at Annexure II.

Dr. B. Renuka Rani, Deputy Director, MANAGE welcomed the delegates for this webinar of public health as well as agriculture interest. She informed the delegates that National Institute of Agricultural Extension Management, known as "MANAGE", formerly National Centre for Management of Agricultural Extension at Hyderabad, is an autonomous extension and agri-business management institute of Government of India established at Hyderabad, Telangana, India. The aim of the institute is to instil managerial and technical skills to Extension Officers, managers, scientists and administrators in the agricultural economy, to enable them to provide support and services to farmers and fishermen for practicing sustainable agriculture. She informed further that rodents are one of the constraints in on-farm agriculture, food and commodity storage, nuisance value and transmits several diseases to humans as well as animals. Hence this webinar is planned to create awareness among pest management technicians, scientists, managers and other client groups.

Dr. RS Tripathi former ICAR-AICRP/AINP on Rodent Control spoke on the ravages being caused by the commensal rodents, particularly mouse plague in Australia in current time, exhaled the need for management of rats and mice co-existing with humans (commensal) with environmentally sustainable methods using non-toxic methods. He informed that MANAGE being an agriculture extension institute has rightly identified the need of such technical webinar to popularize simple non-toxic and inexpensive methods for their management. He traced the role of House rats in historic plague transmission in

human habitations and felt that unless ecological approaches are made, it would be not possible to manage them. He expected that this realization should bring successful rat and mouse management measures with reduced use of toxic rodenticides/fumigants in the country.

Dr. A.M.K.Mohan Rao, International Consultant, who moderated the sessions as Technical Expert explained the theme of the webinar and anticipated deliverables as below. Further, he brought out the needed measures interpreting the reasons for inadequate management results.

- Global importance of rats and mice in agriculture and human habitations
- Zoonotic diseases due to rats and mice to humans
- Practices of non-toxic methods adopted in rat and mouse management and constraints in their management including need for fetching +80% control success
- Habitat analysis, ethological and ecological adaptations of rats and mice for successful survival
- Impact of community based actions of rodent control
- Regulatory issues with the rat and mouse management
- Suggested extension measures of rat and mouse control in rural areas taking into consideration the behaviour of these pesky animals

After formal vote of thanks by Dr. Renuka Rani, technical presentations and discussions followed.

**2. Commensal rodents and characteristics – Dr. A.M.K.Mohan Rao**

While introducing the issues with rats and mice, Dr. Mohan Rao presented the impact of commensal rodents, especially rats and mice in human habitations/establishments in terms of commodity/structural losses and their capability of transmitting human diseases. While 40% of mammal species on the Globe constitutes 1700 species in 29 families, India represents 4 families, 24 genera and 104 species. Among them 2 species viz., House rat (*Rattus rattus*) and House mouse (*Mus musculus*) have global distribution in all human habitations/establishments. In addition, Lesser bandicoot rat (*Bandicota bengalensis*) and Larger bandicoot (*Bandicota indica*) are occasional inhabitants in the human premises.

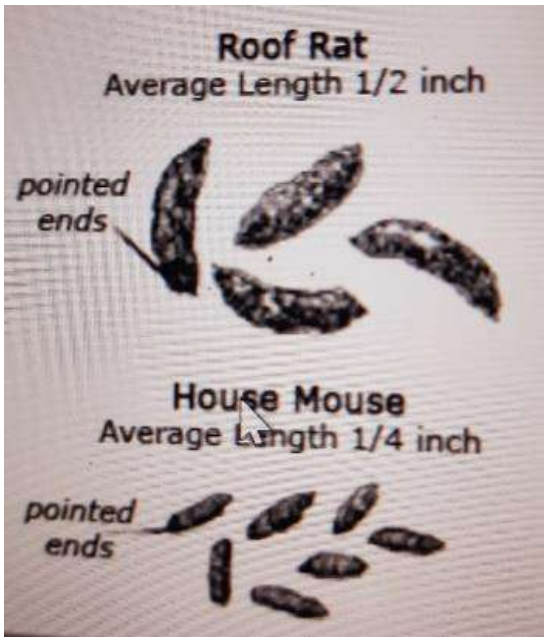
Rodents cause damage to both consumable and non-consumable material with front pair of incisors through nibbling, a habit adopted to arrest the incisor daily growth of about 0.4 mm/day by an average rat. Although they have universal distribution in all human habitations, a scientific study of PAU, Ludhiana reported 300 to 350 rodents in 100 square meters of area in poultry feed godowns. An estimate of 3-5 rats per house was made by Indian Grain Storage Institute, Hapur during 1980s. However, there was no information flow later. The post-harvest rodent losses are approximately 12-16 million MT/year

that can feed of 1/3 of India's poor. Their daily food consumption ranges from 3 to 25 g with a projected loss of about 10 kg/rodent.

| RODENT SPECIES | DAILY CONSUMPTION (G) | YEARLY REFLECTION (Kg) |
|---|---|---|
| *RATTUS* | 8 - 12 | 3 - 4 |
| *RATTUS NORVEGICUS* | 15 - 25 | 6 - 9 |
| *BANDICOTA BENGALENSIS* | 15 - 25 | 6 - 9 |
| *MUS MUSCULUS* | 2 - 3 | 0.7 - 1 |

At the same time 16 million tons of food grains are lost due to spoilage enough to feed 118 million people in the country. At one time, WHO estimated saving of food enough to feed 90,000 persons annually in Mumbai alone with rat/mouse control. This is in addition to their role in zoonotic disease transmission. Studies conducted in India indicate 2.5% of stored food grains are lost to rodents. Looking at the country storage quantities, this loss may appear as insignificant/decimal, but 5 rats, 3 bandicoots and 10 house mice are capable to consume 43 to 57 kg grain in an year. During their outbreak periods, enormous losses to commodities and food grains will occur.

In addition to food consumption in habitations, they also contaminate the grain and commodities with their fecal pellets. Professionals should be able to determine (i) an active rodent infestation from an inactive one, (ii) recognize the difference between house mouse fecal pellets and house rats.




House Mouse faecal pellets measure 3 mm to 7 mm in length with usually one end, or sometimes both ends, pointed. They are capable of producing up to 100 faecal pellets over a 24 hour period. Typically they exude about 50-60 pellets all over their moving areas, an adaptation of chemical communication to mark their territory. The House rats produce about 40 to 50 faecal pellets daily. Their faeces are typically curved, sausage-shaped, and of a smaller diameter and scatter their droppings around in various places to mark their territories, a signal of chemical communication to other rats.

They have capability to reproduce normal way ('k' pattern) or even faster ('r' breeding) way by giving birth to more young ones at favourable conditions that are existing now in Eastern Australia with earlier bumper corn harvest after a prolonged drought period. House rats and

House mice are nocturnal with night time activity period. Hence, their infestation could be diagnosed with the damaged commodities/structures, rat holes/burrows or gnawing signs.




**3. Public Health Importance of commensal rodents in human habitations – Dr. S.N. Sharma**

Dr. S.N. Sharma, Medical Entomologist and former Joint Director, National Vector Borne Diseases Control and Prevention, Ministry of Health and Family welfare, Government of India, Delhi presented to the participants on the need for rodent borne diseases surveillance in the country. Such surveillance should identify cases as quickly as possible so that steps can be taken to control disease spread. A systematic collection of such information on rodents can be used to (i) predict areas where future disease case may happen and rodent epizootics can occur, (ii) identify the most common zoonotic sources of human infection, (iii) identify the most important rodent, tick, mites and flea ecto-parasites for a focused attention to a particular disease, (iv) indicate the hosts and vector species that should be targeted for control measures, (v) assess the effectiveness of prevention and control measures and (vi) identify local ecological factors or human activities that may result in increased plague exposure risks for humans;
Rodent Borne Disease Surveillance consists of three major components:

- **Human surveillance**: Early detection of patients, prompt laboratory diagnosis and proper management of patients is very important. Passive routine surveillance and routine review of the surveillance data to be done under IDSP to detect impending outbreaks of Rodent borne Diseases. Event-based surveillance of unusual suspected cases/deaths related with rodent borne diseases to be done in the control and containment.
- **Rodents surveillance**: The surveillance of rodents in non-endemic as well as endemic areas is to be carried out regularly in real time manner in collaboration with Forest and Veterinary Department.
- **Tick / Mite surveillance**: Tick surveillance and tick mapping for identifying hotspots and tick incrimination studies in rodent borne disease prone areas for monitoring tick positivity for KFD/CCHF/Scrub Typhus to be carried out regularly on periodic basis.

| **Sl. no.** | **Rodent borne Diseases** | **Etiology** | **Reservoir/s** | **Vector** |
|---|---|---|---|---|
| 1 | Kyasanur Forest Disease(KFD) | KFD Virus (Gen.Flavivirus) | *Small Rodents* | Ticks:*Haemaphysalisspinigera OrnithorosChiropterphila* |
| 2 | Scrub Typhus | *Rickettsia tsutsugamushi* | *Rattus spp.* | *Mite:Leptotrombidium Spp.* |
| 3 | Cutaneous Leishmaniasis | *Leishmania major* | *Meriones hurrianae* | *Phlebotomussalehi* |
| 4 | Plague | *Yersinia pestis* | *Tatera indica, Bandicotabengalensis Rattus* | *Xenopsylla cheopis/X.astia/X. brasiliensis* |
| 5. | Leptospirosis | *Leptospira interogans* | *Commensal todents* | |
| 6 | Murine typhus | *Rickettsia typhi(mooseri)* | *Rattusnorvegicus R.rattus,R.exulans* | *X.Cheopis* |
| 7 | Rickettsia Pox | *Rickettsia akari* | *Mus musculus* | *Liponyssoidessanguineus (Mite)* |
| 8 | Encephalomyacarditis | EMC Virus | *Rats and Mice* | - |
| 9 | Lymphocytic Choriomeningiti | Arenavirus | *Mus musculus* | - |

Leptospirosis is a bacterial disease affecting human beings as well as livestock and is caused by *Leptospira interrogans*, which are parasitic in rodents and other animals. There are 26 serogroups of them with about 140 serovars within the species of *L. interrogans.* Pathogenic leptospires survive for long periods in the convoluted tubules of the kidney in rodent hosts, multiply and are shed in the urine up to 100 million leptospires per 1 ml. of urine. They survive in moist warm soil and stagnant waters, particularly if the pH is on the alkaline side. *Rattus rattus* and *Bandicota bengalensis*, are important shedders of the leptospire causative agents of the disease. The disease is more common than ordinarily diagnosed and many so-called *fevers pyrexia of unknown origin* (PUO) are due to it. Plague is another bacterial disease exist from 1896 onwards with rodents as vectors/reservoirs for this bacterial disease. Rodents are primary hosts of the causative bacteria, *Yersinia pestis*, for the plague disease and the oriental flea, *Xenopsylla cheopis,* a rodent ecto-parasite usually transmits infection. Salmonellosis, yet another bacterial disease, is caused by Salmonella bacillus characterised by acute gastroenteritis in man. Contaminated water and food do the transmission by faeces of an infected person or animal, and rodents are very frequently a source of such infection. Although rats are not the only animal source of salmonellosis infection, commensal rodents are one of the major sources.

Among rickettsial diseases, Murine typhus is a widespread, acute, febrile caused by *Rickettsia typhi*. The reservoir hosts of the disease are primarily *Rattus rattus* spreads from house rats to humans through rat ecto-parasite flea (*Xenopsylla cheopis*) bites. This disease is most common in cities and highway open restaurants with high rat populations as well as vector flea. Due to the difficulty in its diagnosis, the disease is under reported in tropical areas where it may be confused with a number of other febrile diseases. Among viral diseases, Kysanura Forest Disease (KFD) is transmitted by *Haemaphysalis* ticks and the disease is maintained in small mammals like house rats. Rodents also play the role of reservoirs in transmission of Leishmaniasis, a protozoan disease belonging to the genus *Leishmania*. Cutaneous leishmaniasis is caused by *Leishmania tropica* through sandfly vector, *Phlebotomus* spp, while Visceral leishmaniasis is caused by *Leishmania donovan*i and widely known as *kala azar* through Phlebotomus sandflies.

The present global warming phenomenon and irregular rain fall (leading to floods and draughts) are stimulating cause for increase in the rodent vector/reservoirs; thereby increase in zoonotic disease burden to humans.

**4. Mechanical practices in rat and mouse management – Rat guards, sealing materials, snap and live traps, metal sheets etc – Dr. N. Srinivasa Rao**

One of the measures for successful management of rats and mice is preventing their entry into the buildings and structures. This emphasizes the need for developing standards in construction of buildings for preventing rat and mouse entry. However, the standards developed are limited to termite management.

| S.No. | Material | Specification |
|---|---|---|
| 1 | Concrete | Minimum thickness of 2 inches (5.1 cm) if reinforced, or 3 3/4 inches (9.5 cm) if not reinforced (Fine chips in 1:5:10 cement concrete) |
| 2 | Galvanized sheet metal | 24 gauge or heavier for wall or pipe barriers;<br>22 gauge or heavier for kick plates or door edging. Perforated or expanded sheet metal grills should be 14 gauge. |
| 3 | Brick | 3 3/4 inches (9.5 cm) thick with joints filled with mortar |
| 4 | Hardware cloth (wire mesh) | Woven, 19-gauge, 1/2- x 1/2-inch (1.3- x 1.3-cm) mesh to exclude rats; 24-gauge, 1/4- x 1/4-inch (0.6- x 0.6-cm) mesh to exclude mice. |
| 5 | Aluminium | 22 gauge for frames and flashing; 18 gauge for kick plates and guards, Floors) |

Existing rat infestations could be cleared using trapping method with a caution that the caught/trapped rat/mouse needs to be disposed of from the site. Such guidelines exist for modern poultry sheds/houses. He emphasised the need to have a building construction code (size and materials to be used for doors, windows and outer walls arising from ground), at least in metropolitan cities for making rodent free structures.

For already existing structures/residential/premises, preventive measures to arrest rat and mouse entry need to be done. Critical inspection of the premises plays a crucial role, before taking up any preventive rodent management measures. He informed that a city like New York has standards stipulated for construction of buildings. Similar measures are needed in India too.

In a given structure, rats get access into the structure either though construction defects or holes made for electrical/cable connections or drain openings. Preventive measures through structural changes could be made to make proofing. This gives permanent relief from rodents. However, if existing structures/buildings have access to rats and mice to enter inside, other curative actions are needed.

He advocated using live traps like wonder multiple catch traps or market available box type traps with proper disposal method. However, in order to kill the rats and mice inside the premises, snap/kill/breakback type of traps are needed to be employed for easy disposal of the dead rats. Safe use and disposal of trapped animals in glue traps is to be standardised as they are highly effective in trapping the in-house populations from different environs.

Rat guards give preventive protection from rat entry in poultries or in bulk buildings or ships. Metallic sheet cones act as effective rat guards with solid metal sheet of min. 0.024 inch (0.61 mm) thick, projecting a minimum distance of 12 inches beyond and on either sides to prevent the rat entry crossing over the metal guard.

There is need to develop/standardize the size, gauge and materials to be used for making rat guards for external and internal usage. Dr. Rao at this stage informed that using such rat guards, rat entry from the ceiling to Prasadam counters at Tirumala Tirupati Devasthanams could be prevented totally in 4-day Tools-on training to engineering unit staff at Tirumala.

**5. Management practices elsewhere**

**5.1. Albania experience: Environmental management as a tool to rodents' source reduction control – Dr. Elton Rogozi, Albania**

Dr. Elton Rogozi from Albania looking after rat control for Albania country gave presentation on source reduction as one of the environmental manipulation technique to prevent rat and mouse problem in Albania country. He stressed that present focus on rodents control is mainly based on chemical control using rodenticide. But, future challenges in the world, strengthen the idea of the non-chemical control of rodents. Source reduction and management comprises the most important tool for the rodents control not using chemicals like rodenticides, but managing, changing and reducing the habitat of rodents through sanitation, source reduction, environmental improving, management and changing, keeping clean and clear every place which attract rodents. There are three steps which are included in

the non-chemical control of rodents through environmental management as a tool to rodent's source reduction control; sanitation, proofing and predation (natural prevention). These steps are part of the IPM – Integrated Pest Management, and are really important to a better future world without chemicals. Rodents require food and shelter; it is most important to reduce the availability of these two key factors; in the case of buildings the most effective method of rodent prevention is the improvement of hygiene or sanitation in and around them; removing food scraps left over from feeding pets or domestic stock; with reduced access to food and no places to hide, rats will not become established, that is live and breed, inside a building, regular disturbance is something rats and mice avoid.

**Rats avoid clear spaces**

- Keeping a clean and clear surrounding, building, yards, kitchen-gardens, etc.;
- Managing all the gathered materials, inert materials etc;
- Keeping all surrounding washed and clean, disinfected preventing rats to be attracted form the smells produced.

**Vegetation management**

- Branches overhanging the building should be lopped off to prevent climbing species to enter from above;
- Cutting additional vegetation, herbaceous and shrubby vegetation;
- Removing the contact of trees and shrubs with the ground and the buildings.

**Waste and trashes management and proper handling**

- Daily human and animal waste should be proper managed and stored in defined location, where they may be later proceeded and processed;
- Trashed collected in a sustainable manner and properly handled;
- Human responsibility, rather than the local authorities and waste management bodies;
- Personal education of waste collection and not throwing everywhere.

**Sustainable waste management, properly**

Since it is not practical to remove all food from stores and households, it is necessary to restrict access by rats; when rodent-proofing a building, only materials which they cannot gnaw through should be used, In addition, some rodent species are good climbers and jumpers, and most can squeeze through surprisingly small holes and cracks; Floors and walls should be kept in good repair; Predation, is a natural way to control rodents, but not sufficient to keep their populations in controlled numbers.

Steps on rodent's prevention should consider making sure all doors fit tightly with no gaps; sealing up any holes that are at least ¼ inch in diameter on the outside of the building; trash receptacles and dumpsters should have tight-fitting covers; keeping all indoor and outdoor areas free of debris and clutter; storing grain, pet food, and other food products in sealed, metal containers; trimming trees and shrubs back from the building to prevent rodents from using them to gain access; storing firewood at least 20 feet from the home and five inches off the ground.

**Floor damaged wood/betony**

**Damaged foundation**

**Floor meshing**

**Floor filling and repair**

As innovation tools there are same important steps like sanitation recommendations to reduce rodent harbourage and attraction; rodent-proofing advice such as sealing holes and cracks to prevent entry;

traps to capture and eliminate and prevent rodent entry; reducing habitat and distribution of rodents; environmental management to reduce the rodent's habitat extensions.

**5.2. Sri Lankan Experience: Rodent control in Sri Lanka is carried out by Farmers, Professional Pest Control and by the Consumer. – Dr. Raja Mahendran, Sri Lanka**

Dr. Raja Mahendran, International Pest Control Business Manager from Sri Lanka with his 37 years of experience gave presentation on rodent management practices adopted by farmers, professional pest control personnel and by the consumer. Farmers suffer damage mainly to rice and Coconut. They use mainly traditional methods including leaves of Gliricidae sepum, bottom leaves of Pineapple, raw Papaw and Goat poo. They also use chemical rodenticides.

The professional Pest Control Personnel mainly use brodifacoum wax blocks, brodifacoum pellets, Glue traps. A couple of companies – (i) Suren Cooke with digital rodent control and (ii) The Exterminators with e-scanning of bait stations are leading in the digital mode. Hayleys have a non-toxic device Good Nature that physically knocks out rodents. CIC are the market leader with rodenticides brodifacoum Blocks and Pellets and highly recommend hygiene and proofing, prior to chemical use as shown in the example with the poultry farm.

The Consumer uses mainly glue traps and bromadiolone wax blocks purchased from the supermarket for rodent control. The well to do of course engage a PCO for rodent control.

Because of the regulatory environment in Sri Lanka, there are only two rodenticides mentioned already, i.e., Bromadiolone and Brodifacoum. The present trend is towards non toxic control. In the past, rodent control meant putting bait trays and changing the bait. This is no longer acceptable. With global food audit standards having an impact and international companies insisting on documentation and trend analysis, calls for the industry to up their game. Hand held apps such as e=PestReports can help meet HACCP compliance and that of international food audits.

**6. Smoking rat burrows - an effective way for control – N. Srinivasa Rao**

In earlier times, rat holes were used to be smoked as a method for rat control. However, among commensal rodents, rats will not make burrowers although mice do make small holes. However, the Lesser bandicoots and Larger bandicoots also make their burrows adjoining the residential premises, periphery of the buildings/structures and in open areas. Smoking these burrows will kill lesser and larger bandicoots and is one of the effective methods to control them. In these the hose rats, which are occasional occupants of these burrows also die in this process. In recent days, reports also exist on snakes

occupying these holes sometimes. Smoking in that way make the premises devoid of snakes also since they get killed with burrow smoking.

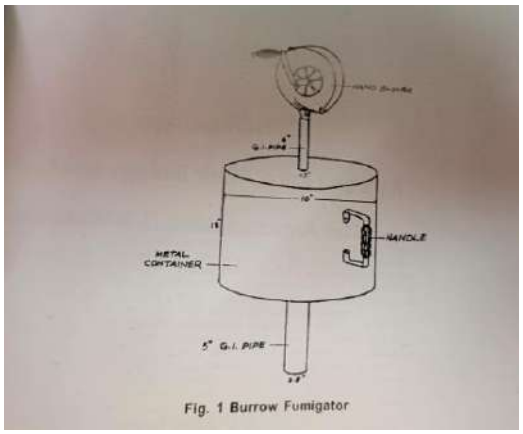


Fig. 1 Burrow Fumigator

Dr. Srinivasa Rao, gave presentation on the model developed at their Regional Agricultural Research Station, Maruteru. The AP Agriculture University developed the units in early 1990s, while PAU initiated the studies the in recent times. Each unit consists of a hollow cylinder of 10" diameter and 10" height made of 18 gauge MS sheet. In the centre of the cylinder a rectangular window of size 6"x 4" with cover has been cut for putting the straw inside the cylinder. The outlet at the bottom is made of G I pipe of 8" length and 1.8" diameter. The inlet is on the top made of G I pipe of 6" length. At the top of inlet an air blower has been fixed.

The device was found to be very affective for the control of Lesser bandicoot rat, *Bandicota bengalensis* in black soils with the cost coming at Rs. 3.45. However, the economics in comparison with aluminium phosphide (1.5 g) per burrow, the cost comes to Rs. 2.56 per burrow. While using burrow smoking needs field labour, treatment with aluminium phosphide is risky to persons applying the tablets. There is need to evaluate this in Punjab due to different type of soil structure and also species – *Nesokia indica*.

Engaging rat catchers is also a practices in some rice growing areas; however, the cost per rat caught comes to Rs. 5, which is expensive on comparison.

**Economics of burrow fumigation in comparison with ALP**:

| S.No | Particulars | Fumigation with BF | ALP @1.2g/burrow |
|---|---|---|---|
| **1** | Total No.of burrows treated | 280 | 280 |
| **2** | No. of works days required | 14 | 7 |
| **3** | Cost of labour@Rs68/woman/day | Rs.952 | Rs.476 |
| **4** | Cost of input | Rs.14 | Rs.240.80 |
| **5** | Total cost | Rs.966 | Rs.716.80 |
| **6** | Cost of input/burrow | Rs.3.45 | Rs.2.56 |

This model became popular after its introduction in early 1990s and even Government of Andhra Pradesh included it as one of the approved implements under Farm Machinery subsidy by the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. He also informed that smoking of rat burrows using crop residues near garbage bins, gardens and other public places was found effective and eco-friendly, although scientific data were not collected. It is also felt that smoke pipe from the smoke generating drum needs to be developed to pump the fumes inside the rodent burrows. For this, the design of the 'burrow smoker' device needs slight modification to insert long pipe for delivery of the smoke. Both AINP Centres of ANGRAU Maruteru and PAU, Ludhiana can modify the unit accordingly and evaluate the performance to use in open areas, parks and drains in the local body areas.

**7. Issues in rat and mouse management and remedial measures – Dr. A.M.K. Mohan Rao**

Dr. Mohan Rao analysed his International Consultancy experiences in Armenia, India, PR China and USA and explained the common reasons for ineffective management and need for appropriate measures for their prevention. This is because of mostly because of their behavioural adaptation to withstand nature's vagaries and human effort to eliminate them. Dr. Rao presented on various adoptive features of rodents and problems faced to get affective rodent management success which included rodent behavioural approach and others.

***7.1. Individual and casual approach:***

Rats and mice maintain home range and once that rat is killed, other one will fill the space leading to the rodent to take faster '"r" breeding mode producing more young ones. This will lead to population

increase instead of decrease. This specified the need for community involvement to prevent adjoining rodents occupying the home range of their killed ones. Simultaneous measures in all buildings/structures/technology parks is needed to prevent immigrant rats to breed in areas already treated for rat and mouse management. Casual human approach also affects the efficacy of rat and mouse control. Normally on seeing few rats or mice dead the continuity will be stopped giving the left over survivors to build their strength.

### *7.2. Faster breeding/r pattern:*

Apart from them, rodents have intrinsic capacity of regulating their populations through normal (k) and faster (r) breeding modes. During favourable conditions when congenial habitat, normal food are available the female rats and mice will have normal breeding with mean litter size of 6 young ones per female rat. However, when ample food is suddenly available like in Australia now after last year bumper corn yields, the litter size goes over 20 embryos per female with sex ratio favouring females. In addition, the maturity period also comes down. This makes switching to faster breeding mode resulting enormous number of young ones. Added to this, absence of maternal cannibalism at "all is well" situation contributes to outbreak of the population. This is regularly observed in Godavari and Krishna delta areas of Andhra Pradesh. Once normal situations return, their breeding will be automatically restored to "k" pattern with 6 embryos/female. This type of abnormal mode was observed at Tirumala shrine, when part of the house rat population was removed. In most of the human habitations, such a phenomenon is normal and need exists to create awareness among residents/clients on the need of community level rat and mouse management to prevent the switching over to faster mode or "r" pattern of breeding.

### *7.3. Theigmotaxis*

All small mammals including rats and mice move aligning vertical surfaces. Keeping traps and any appliance or bait on their runways aligning walls or bunds etc will make them to freely accept entering

in traps or eat the baits. Hence trap/bait placement plays a key role in the efficacy of their management. This also makes the placement in their normal home range. It was observed that farming community apply poisons above the bunds and complain that they are not eaten unaware of the theigmotactic behaviour. Hence need exists to create awareness among residents that the placement should be aligning vertical surfaces or in bait stations rather than in open places.

### *7.4. Neophobia*

Rats and mice have the habit of exploration or '*searching*' behaviour before they settle in a new environment. This exploratory behaviour is defensive for them to alert any issue in the newer locality. Once any change in the habitat occurs, they will get alert, a new behavioural trait called "neophobia" or "new object reaction". This is a temporary behavioural adaptation and they adjust in 1 to 5 day time. Hence this neophobic avoidance period needs to be taken to consideration to get affective results.

### *7.5. Use of ultrasonic devises*

The sense of hearing among rodents is above 20 kHz thus extending well into ultrasonic range. Hence, ultrasound devices can be used as deterrents to rodent immigration. Since the sound waves travel horizontally, any object in between prevents their travel, which can be taken advantage by domestic rodents. Secondly they have limited role in storage godowns, wherein rats and mice hide in between sacks. However they can be employed at rat entry points to prevent the rat/mouse entry. So far no convincing evidence was found them as effective against rats. Changing to alternate frequencies also did not yield significant difference.

### *7.6. Role of predators and pathogens:*

Cats in residential premises are one of the examples. Since most of the predators of rodents like cats are general feeders, they often tend to feed on food other than rodents. Declined rodent population after also makes the predators to leave the area. There is also sometimes a possibility of predation triggering increase in rodent populations after partial removal of the rodents. Attempts were also made with parasites and pathogens to bring successful rodent control. However, the efforts are so far not fruitful since they also equally affect human populations.

### *7.7. Use of repellents:*

| Formulation | Effect of repellant | | | |
|---|---|---|---|---|
| | Rodent infestation (Rodent burrows) in | | Damage incidence (%) in | |
| | Treated area/ha | Untreated area/ha | Treated area | Untreated area |
| Granules | 15.13+ 4.31 | 57.8 + 3.89 | 5.51 +1.58 | 29.4 |

Repellents appeared promising against rats and mice, although several repellent products are being evaluated including AINP project. As a traditional method, neem leaf is being used in storage areas of houses. Dr. Mohan Rao informed that one such product that is widely used is a castor based extract evaluated at National Institute of Plant Health Management (then NPPTI), Hyderabad in 2000s either through spray around the structure/crop or roping or granular application. Impact of this castor based repellent could be seen with number of rat burrows in open areas.

The burrow number was recorded as 15.13 per hectare, while in un treated open areas, it was 57.8 burrows. This repellant is an area repellent and small mammals including wild boars are repelled with its smell. The main ingredient is resinolic acid mixed with emulsifier stabilizers and smelling agents derived from natural resources. Its application repels rats for over a month. The product is neither toxic nor harmful to handle. At present time it can be used at all entry points to prevent rat and mouse entry. However, it will not impact on already established population inside the structures. It is currently used by several State Governments under SMPMA of Agriculture Ministry assistance.

### *7.8. Reproductive inhibitors:*

So far no anti fertility/reproductive inhibitor has shown any promising result. Work by ICAR – AINP centres is in infancy stage and in progress.

### *7.9. Summary of remedial measures:*

The following measures are suggested as remedial for effective results:

- Good house-keeping – Clean premises and regular maintenance
- Scientific storage - maintenance of dunnage, space between stacks and from the walls, proper stack maintenance.
- Elimination of harborage in adjoining areas and cleanliness of stores discourage rodents to make their habitat
- Scientific way of storage Viz. using rodent proof structures like metal bins, rooms and pucca kothies, including the units, sealed and properly cleaned structures,

- Trapping – live traps (trapped ones should be killed and disposed and should not be thrown outside; Kill/Snap traps (dead rats need immediate disposal).
- Repellants – Use of repellants viz., neem leaf, castor based extract either through spray around the structure or roping or granular application.
- Ultra sound units – High sound frequency above 18 kHz, which repel rats and mice away from entering in the room
- Although rearing cats is age old method, they are ineffective due to their adjustment with human food and won't go to hunt the rats and mice within the premises.
- In any case rat and mouse can be controlled with poison baits only as a last resort and application of rodenticide cakes inside the premises needs to be discouraged. These ready-to-use baits kill part of the population which stimulate the "r" pattern of breeding.

**8. Achievements of community actions in Andhra Pradesh – Mr. Jaya Kumar**

Andhra Pradesh state faces regularly rodent outbreaks at 4 year and 10 year periodicity. The Department of Agriculture, AP resorts to community level rodent control measures involving whole village community taking district as a unit. Mr. VDV Krupadas Joint Director of Agriculture Inputs and Mr. Jaya Kumar, former Joint Director RKVY, sent the input on their efforts from 1990s guided by Dr. Mohan Rao, NPPTI/NIPHM and how they could achieve community participation with centralized bait preparation at Village Panchayat buildings (a centralized place) and distributing the 20 g bait packets to farmers based on the rodent infestation in their fields.


Mixing of rodent baits

Bait packet application inside the burrows

| Statement showing the details of Physical & Financial achievement under RCP from 2014-15 to 2020-21 | | | | |
|---|---|---|---|---|
| **S.No** | **Year** | **Treated Area (Lakh Ha.)** | **Expenditure (Rs.in lakhs)** | **No.of armers benefited** |
| 1 | 2014-15 | 9.99 | 107.60 | 842573 |
| 2 | 2015-16 | 12.50 | 116.39 | 850910 |
| 3 | 2016-17 | 13.57 | 135.03 | 958742 |
| 4 | 2017-18 | 8.91 | 101.02 | 706872 |
| 5 | 2018-19 | 14.20 | 165.42 | 1,215,000 |
| 6 | 2019-20 | 13.05 | 161.99 | 1195700 |
| 7 | 2020-21 | 12.03 | 138.46 | 918832 |
| | TOTAL | 84.25 | 925.9 | 6688629 |

Farmers are applying the bait packets inside the burrows in their respective fields soon after collection. Farmers are aware that the baits will not be eaten unless they are fresh due to development of rancidity of oil content in the baits. Anti rodent campaigns are being organized in villages every year by involving *Raitu Bharosa Kendra* (RBS) committee members, MDOs, Panchayat Raj Officers, Village Secretaries, VAOs, VAAs, MPEOs, AEOs and SHGs on community action mode. State level, District level, Mandal level & Village level committees are being involved for successful planning, execution, monitoring & evaluation of the Rodent Control Campaign at field level. Similar approach is needed in all local bodies to treated waste lands, public places, parks, industrial corridors and drainage canals for long lasting results.

In all cases, evaluation of the activities are being conducted at District level from time to time and State Headquarters once in four months. It is ensured that the program will reach to every luke end corner of farmers' fields. A total 84.25 lakh hactares of rice growing areas were treated covering 7 districts from 2014-15 to 2010-21 using Rs 925 lakhs benefitting 66.8 lakh rice farmers. Such campaign mode measures in Metro cities covering open areas, drains, public places, office premises could bring effective results from bendicoots and rats inhabiting the areas.

**9. Regulatory issues with inputs concerning rat and mouse control – Dr. T.P. Rajendran**

Dr. TP Rajendran, former Asst Director General, Plant Protection, ICAR was closely associated with regulatory bodies over 3 decades made an observation that India is basically a rural based one rat and mouse problems are more in these habitats and no regulatory systems exist with respect to rat and mouse management in these rural dwellings. The following are outcome of his presentation:

i. Proper assessment was not done after 1970s by any institutional system on economic impact of rats and mice in rural dwellings in spite of their high vulnerability. Hence a survey based data needs to be developed by civic bodies from proper funding sources.
ii. There is need for self-regulatory practices than from regulatory and civic authorities. Trash collection by residents and its disposal by civic authorities discourage rodent harbourage, which drives the rats out. Responsibility for individual structures like houses, drains need proofing and maintenance by residents themselves.
iii. Fodder and feed are responsible for contamination with urine and feces in most of the rural areas.
iv. The food and packaging industries catering food needs to residents in these Covid days needs preventive actions. Guidelines for maintenance of buildings need legal action for instituting punitive actions on Apartment body or concerned residents. Although such legal provisions exist in Metros, they are hardly followed.
v. Good management practices in food business units keep them away from the premises. Ornamental plants give pleasant feeling to residents and will not afford harbourage and hence need to be grown. Regular dump clearance drives out rats from house/apartment premises.
vi. Trapping can be used as a surveillance tool. Sticky traps are best way for surveillance since it suggests ways for proofing.
vii. Covid 19 management strategy works effectively using mass media. It gave 0 results in message transfer and awareness creation. FM Radio could be used for short message transfer to rural people on effective rat and control measures.
viii. All the FM channels and Ham radio shall be partners of Government machinery that looks to implement regulations on rat proofing in human habitations twice in a year as a part of institutional interactive campaign models.
ix. All TV and mass media such as whatsapp groups, Twitter, Facebook and such others shall have repeated messages for desirable prioritized attention to public on self-regulation model.
x. All farms, animal husbandry, poultry, fisheries enterprises and their contracted production units shall be given alerts.

**10. Usage of botanicals, and sticky traps etc. for rat and mouse management – Dr. A.M.K. Mohan Rao / Dr. Mani Chellappan / Dr. Neena Singla, PAU, Ludhiana**

Following supplementary observations were made by Dr. Mohan Rao. Rodent management including managing rats and mice became centric on usage of toxic chemicals for their management. Central Food and Technological Research Institute, Mysore and Indian Grain Storage Management Institute (IGMRI) under Department of Food, Government of India reduced their work on rodent management in post-harvest conditions, although they were active till 1980s. ICAR-AINP is dealing with field rodent control in

the country with its cooperating centres. However, rat and mouse control did not take researchers' attention since ICAR primarily looks after crop field problems. This has led to field day for commensal rodents. However, few ICAR-AINP Centers have taken up working with some products which were presented as below:

Elsewhere, maize cob powder is being used as affective rodenticide in Western countries. The crop residue, i.e., the cob of maize is powdered and used against rodents with promising results. A study by Dr. Mohan Rao indicated a success of 66% *Rattus rattus* in poultry environs as reported by Dr. Sakthivel, National Institute of Plant Health Management. However, AINP needs to study its efficacy against other species and situations. This appears to an virgin and open area for research by concerned organizations.

**Mortality rate of House rat after fed with Cellulose-based rodenticide pellet bait exposed for 8 days under no-choice test**

| Sex | Body weight of the animal | No. of animal | Consumption of cellulose based rodenticide (g) (Mean ± S.E.) | | | Mortality (%) | Days to Death |
|---|---|---|---|---|---|---|---|
| | | | Before the treatment | During the treatment[1] | After the treatment | | |
| **Male** | 116.5 ± 4.2 (107 – 125) | 4 | 11.0 ± 1.35 (9.1-15.2) | 27.5 ± 3.0 (21.2 – 33.0) | 7.5 | 25 | 7 |
| **Female** | 106.2 ± 6.1 (90 – 125) | 5 | 12.4 ± 0.9$^{NS}$ (11.9-15.9) | 25.1 ± 1.7 (21.0- 30.9) | 8 | 80* | 6.5 ± 0.8 (4 – 8) |
| **Total** | 110.7 ± 4.1 (90-125) | 9 | 11.7 ± 1.0 (9.1 – 15.9) | 26.1 ± 1.5 (21 - 33.0) | 7.25 | 55.5 | 6.6 ± 0.6 (4 -8) |

$^{NS}$ The non-significant ($p>0.05$); *Significant ($p<0.05$)

[1]Average of eight day consumption of cellulose bait.

Values in the parenthesis are range

It is a widely known fact that rats cause significant damage to coconuts on the tree crown itself ranging from 18 to 24% in the country. Since preventing the rat climbing the coconut trees is one of the effective methods to arrest this damage, trunk banding is widely used. Dr. Mani Chellappan, Prof and Head,

Self sticking polythene sheet banding

Entomology and incharge AINP VPM, Department of Entomology, at Kerala Agricultural University (KAU), Thrissur developed an innovation – self-sticking film polypropylene band with 50 micron thickness and 30 cm breadth. This band when wrapped and fixed at 6 feet high to the trunk prevents the rat climbing the tree. KAU evaluated both metallic trunk banding with 25 guage galvenized iron sheet with 30 cm width, and self-sticking pads for their efficacy in preventing rat climbing on to the trunk. Such self-sticking tape appears to be effective in poultry houses also, wherein house rats enter the chick trays from the roofs of the sheds. He informed that both yielded 100% result on rat climbing the palms. The longevity is about 1 year and cost comes to Rs. 100 and 20 respectively showing cost economics. It is felt that the AINP Centres of ANGRAU, Gujarat Agricultural University and Assam Agricultural University also evaluate their efficacy against *Rattus rattus* in coconut orchards.

The Pest Management industry also may take a lead since this is one of the potential business areas for them.

Dr. Neena Singa, Punjab Agricultural University, Ludhiana gave a brief on their AINP center work achievements on repellants, reproductive inhibitors and burrow smoking equipment. She informed that their centre evaluated several botanicals for their efficacy to prevent rat and mouse problem in domestic situations. Patenting of one repellent is in process and requested the pest management industry to take the patent on approval. She also informed that work is being conducted with several essential oils. It was suggested that evaluation of botanicals, repellents and reproductive inhibitors etc could be taken up by AINP centres only after any industry associates and shows willingness to bring the said formulation.

Metal sheet banding against rodents

## 11. Reactions of Pest Management Associations

While appreciating the initiative taken by the Director General, MANAGE to organize such a webinar of a subject of "complacency", the Pest Management Industry made a unanimous observation that at present SOPs are not available for rat and mouse control in human dwellings including municipal open areas, technology parks and drains. This is causing problem with the technical audit in these areas. Developing a protocol would go on a long way and avoids these problems, not only training their internal staff.

Mr. Prakash Sasidharan, President, IPCA thanked MANAGE for organizing this aptly identified webinar, which cleared apprehension that only way of commensal rodent control is application of poison baits and fumigant. To spread this message he suggested strategic training programs on commensal rodent management. He expressed a fear that banning non-poisonous sticky traps may be detrimental for the ongoing domestic pest control including the pest control industry, which may have zoonotic disease threat to house hold persons and public. Till necessary alternatives are introduced the ban notification needs withdrawl. He also suggested that alternative organic non-toxic methods like repellents or reproductive inhibitors can be developed. At the same time attention is needed on bringing out Standard Operation Procedures (SOPs) for commensal rodent management not only as a guiding document to pest management professionals, but also to come out of clutches of Auditors.

Mr. Siva Kumar, President, PMPWAM also thanked MANAGE for this thematic webinar bringing together experts as well as pest control clientele. He informed that in Mumbai Metro methods like leaving space around structures is impracticable and need exists to go with alternatives by developing SOPs in different situations, viz., residential areas, industrial corridors and public enterprises like Indian Railways, Airlines and public and private undertakings.

Mr. Sarang Savalekar, President, PMA also congratulated MANAGE for holding such a webinar and experts to give many new information on commensal rodent management. He felt that the need of the day is working out thresholds for structural specifications viz., preventive tools, smoking drum, pipes etc. to spread this appropriate knowledge to all pest management professionals.

At this, Dr. Mohan Rao, Moderator suggested that SOPs for commensal rodent management needs to be drafted after identifying 3-4 scientists/experts and taken for further actions. He also informed that Pest Management industry inputs also need to be taken. It was further suggested that a number of claims have come on non-toxic repellents, but most of them were never scientifically evaluated/tested. This brought unsavoury reaction from clients of failure of them. It was suggested that the recommendations

of the webinar may be sent to ICAR (ADG PP&BS) to workout research aspects by AINP on Vertebrate Pest Management for coordinated work on the product development following uniform methodology.

**12. Closing / Valedictory Session**

Dr. RS Tripathi, former Project Coordinator for AICRP/AINP on Rodent Control in his valedictory address stressed that killing and removing individual rats and mice is not rodent control. It should be economical, eco-friendly, acceptable to society and safe to the environmentally sustainable. Managing rats and mice with non-toxic methods took a major place at global level although is a part of integrated rodent pest management. With the level of existing zoonotic disease burden, it is desirable to avoid them in premises, where community live. Under such conditions, it is timely for MANAGE to take up such webinar involving all stakeholders and bringing in very interesting and informative presentations from experts. He stressed that in municipal and local bodies community level actions for rat control can be taken through prompt collection and disposal of wastes. He felt that it is time to bring standard operation procedures by MANAGE for effective commensal rodent management and also to avoid technical audit problems in software and other commercial parks. He thanked Dr. Renuka Rani, MANAGE for coordinating this webinar for its success. Dr. Renuka Rani extended vote of thanks to Dr. R.S. Tripathi for his opening as well as closing remarks, the Director General for providing all facilities, Dr. Rogozi and Dr. Mahendran as well as all experts including the Presidents of Pest Management Associations for their expert presentations and inputs.

**13. Recommendations**

1. Currently Standard Operation Procedures (SOPs) are not available for rat and mouse control in human dwellings including municipal open areas, technology parks and drains. They are confined to recommendations in individual research papers only. There is imminent need to bring out simple operation procedures for non-toxic methods of rat and mouse management collating from available research results. Developing such a procedure would go on a long way not only for effective management as well as training purpose but also makes technical audit easier. MANAGE brought out a very descriptive Guideline publication – *"Extension guidelines for pest/vector management in human habitations"*. There is scope to bring out SOPs for all entities to manage noxious rats and mice.

   **Action: MANAGE / ICAR**

2. The national policy on building structure construction code (size and materials to be used for doors, windows and outer walls arising from ground) at least in metropolitan cities is identified in the

webinar, for making rodent free habitations. Similar Code can be extended to all local bodies for enforcing in all types of rural dwelling construction also.

**Action: ICAR / CBRI**

3. Suitable coordination from MANAGE for circulating to district authorities Guideline and SoP on rat and mouse management in dwellings and human habitats for adapted execution in consultation with experts. These may be communicated to all local bodies, public undertakings, pest management associations for adoption and execution through their respective programmes.

**Action: MANAGE / MoUD**

4. A survey based data may be developed by civic bodies on rodent incidence in habitations and also on losses being accrue. This is needed to be coordinated by Ministry of Urban Development. In 1960s such a survey was published by WHO. Since then, such national survey-based documents have not been prepared. Initially pilot based study may be taken up by AINP on VPM.

**Action: IGMRI / CSIR / ICAR / MoUD**

5. Since management of rats and mice comes under Ministry of Food, Civil Supplies and Distribution, IGMRI, CFTRI and ICAR-All India Network Project on Vertebrate Pest Management may take up evaluation of repellents, botanicals and scientifically proven reproductive inhibitors. Pesticide and Pest Management Associations/Industries may be associated during these studies.

**Action: IGMRI (MoFCS&PD) / CFTRI / ICAR /**Pest Management Associations

6. Pesticide / Pest Management Industries are advised to get their products viz., repellents, ultrasonic devices, botanicals like maize cob, reproductive inhibitors etc. scientifically evaluated before tapping the market. This could be taken up by ICAR-AINP VPM centres or other appropriate research laboratories only using approved evaluation protocols.

**Action: ICAR / Pest Management Associations**

7. Burrow smoking equipment developed by ANGRAU, Maruteru yielded effective results in crop fields. It appears to be effective equally in urban and local body environs. Needful changes to the equipment may be incorporated for its affective utilization. Large-scale production of the prototype has to be encouraged by local artisans.

**Action: ICAR AINP VPM/ANGRAU**

8. Activating through seasonal celebration of rat and mouse management campaign week can stimulate local campaigns in all districts. Simultaneous measures in all buildings/structures/technology parks/industrial bodies, open areas, drains, public places, office

premises etc. in campaign mode may be encouraged to prevent immigrant rats to breed in areas already treated for rat and mouse management. MANAGE may facilitate a 2-day workshop to concerned urban development authorities.

**Action: MANAGE / MoUD / MoCS&PD/Pest management Associations**

9. Till necessary alternatives like repellents, reproductive inhibitors are introduced, the ban notification on sticky traps needs withdrawal by Animal Welfare Board of India.

**Action: AWBI**

10. The AINP Centres of ANGRAU, Gujarat Agricultural University, University of Agricultural Sciences, Bengaluru and Assam Agricultural University may evaluate the efficacy of galvanized iron sheet trunk banding and self-sticking tape (as developed by Kerala Agriculture University) since coconut orchard rodent damage is rampant in these States.

**Action: ICAR AINP VPM/Coconut Development Board**

**ANNEXURE- I**

List of Participants of Webinar on
Safe and Effective Use of Non-Toxic Rodent Management Methods
for the Control of Rats and Mice in Human Habitations
Moderator: Dr. A.M.K.Mohan Rao

| S.No. | Name of the participant | e-mail |
|---|---|---|
| **1** | Akhilakaldari | akhilakaldari12@gmail.com |
| **2** | Rinatilak | rinatilak@hotmail.com |
| **3** | Indulkar sp | indulkarshailu@gmail.com |
| **4** | ADA Narasapuram | adarnsp@gmail.com |
| **5** | Airport Health Officer Trichy | aphotrichy@gmail.com |
| **6** | Akhil Rana | akhilrana@yahoo.com |
| **7** | Amani Reddi | reddiamani2@gmail.com |
| **8** | Amruthraj Radhakrishnan | amruthraj.dghs@gmail.com |
| **9** | Anil Mazagaonkar | opalpc@gmail.com |
| **10** | Anil Rana (AGRORGANIC PEODUCER COMPANY LIMITED) | anilrana2168@yahoo.com |
| **11** | Anup KarmaKar | indianpestsolution@gmail.com |
| **12** | Anusha Bonku | anu06subha@gmail.com |
| **13** | apparao.palagara | appu.ram369@andhrauniversity.edu.in |
| **14** | Ashok Kumar | ashok.pcci@yahoo.com |
| **15** | Avadhesh Katre | katre_avadhesh@yahoo.com |
| **16** | Avijit Parua | avijitparua95@gmail.com |
| **17** | Ayandev | ayandev.mukherjee@ipc.org.in |
| **18** | B Anusha | b.anusha@angrau.ac.in |
| **19** | Balamurali | balamurali@hvlpestservices.com |
| **20** | Baliram Sangle | biochempestpune01@gmail.com |
| **21** | basavadarshan | basavadarshan@gmail.com |
| **22** | Basker Parasuram | drbasker60@gmail.com |
| **23** | bhaskar naik | bhaskarnaik8454@gmail.com |
| **24** | Bhupen | patilbhupen8@gmail.com |
| **25** | Binay | bpeskolkata@gmail.com |
| **26** | Bindu Bala | binduvardhan21@gmail.com |
| **27** | Bhupender | bhupinder@pau.edu |
| **28** | Vector Borne Diseasesconsultant | vbdconsultantrjn@gmail.com |

| | | |
|---|---|---|
| **29** | D S Dhumal | apc1998@yahoo.in |
| **30** | David Shalem | davidshalem@gmail.com |
| **31** | Devanathan Sukumar | devanathansukumaran@gmail.com |
| **32** | Dharmendra Kumar | dharmendrkumar2211@gmail.com |
| **33** | Dheeraj Mohan Singhal | nativeconcept1@gmail.com |
| **34** | Dilip kumar | pestrackpestcontrol@gmail.com |
| **35** | Dinesh | awoc09@yahoo.com |
| **36** | Dipti Ranjan Mahapatra | diptiranjan@gmail.com |
| **37** | Dr Arun Chauhan | drarunchauhanncdc@gmail.com |
| **38** | Dr Jyotsna | jyotsna.mandadi@gov.in |
| **39** | Dr Pavani k | pavanikommu16@gmail.com |
| **40** | Dr Ramesh Bhatta | ento.idsp.assam@gmail.com |
| **41** | Dr Ravikiran | ravikirankattimani@gmail.com |
| **42** | Dr Sweta Bhan | drsbhanncdc@gmail.com |
| **43** | Dr T.D.Khatri | drtdkhatri@gmail.com |
| **44** | Dr Tejdeep Kler PAU | tejdeepkler@pau.edu |
| **45** | Dr V Vasudeva Rao | vasuvaidyula@gmail.com |
| **46** | Dr Vasantha | g.vassu9@gmail.com |
| **47** | Dr. I. Aruna Sri | issaiaruna@gmail.com |
| **48** | Dr. K. N. Rao | doctorspestcontrolservices@gmail.com |
| **49** | Dr. Mani Chellappan, KAU | mani.chellappan@kau.in |
| **50** | Dr. Ramesh Bhatta | ento.idsp.assam@gmail.com |
| **51** | Dr. S.N.Sharma | drsns.nvbdcp@gmail.com |
| **52** | Dr. Sarang Savalekar | savalekar_pestcon@yahoo.com |
| **53** | Dr. Senthilnathan | quarantinechennai@yahoo.com |
| **54** | Dr.C.Padmavthi | apspo.nvbdcp@gmail.com |
| **55** | Dr.D.Sukumaran | devanathansukumaran@gmail.com |
| **56** | Dr.K.Malla Reddy | doctorkmreddy@gmail.com |
| **57** | Dr.Namala Srinivasa Rao | nsraoento@gmail.com |
| **58** | Dr.Ragunathan | ragunathan_v@yahoo.com |
| **59** | Dr.Subin.S | subin@cghs.nic.in |
| **60** | Dr.Vaisakh T P | vaisakhtp@gmail.com |
| **61** | Gubba kamalakar | kamalakardubba786@gmail.com |
| **62** | Elton Rogozi | eltonrogozi@yahoo.com |
| **63** | Friedaeugenia Hinge | friedaeugeniabareh@gmail.com |
| **64** | G S S Prakash | gss.prakash@gmail.com |

| | | |
|---|---|---|
| **65** | G.Sai kumar | gsaikumar777@gmail.com |
| **66** | Gagan malhotra | gagan.malhotra@syngenta.com |
| **67** | Gopal Deole | ganrajpestcontrol.ser@gmail.com |
| **68** | Gubba Prashanth | gubba.prashanth@gubbacoldinfra.com |
| **69** | Gurpreet kaur | gurpreetkaur002100@gmail.com |
| **70** | Hemant Desai | hemant@ankitapestcontrol.com |
| **71** | Hrishikesh Joshi | hsjoshi19@gmail.com |
| **72** | Indulkar | indulkarshailu@gmail.com |
| **73** | Jagan | thiyagarajanjagan@gmail.com |
| **74** | Jayakumar V | jayakumar_vundru@yahoo.com |
| **75** | kamalakannan | kamalakannanphd@gmail.com |
| **76** | Kaustubh | p.kaustubh1915@gmail.com |
| **77** | Kiran Robert | kiranrobert@baruch.co.in |
| **78** | Komal preet Kaur | kkomalpreet954@gmail.com |
| **79** | Lal Fakzuala | fakaento@gmail.com |
| **80** | M.S.Sasi | adentomology@gmail.com |
| **81** | Maheswari | maheshwarithirumoorthy1@gmail.com |
| **82** | Manage@123 | borahratul09@gmail.com |
| **83** | Manoj Kumar | mansnr@pau.edu |
| **90** | Mantri someswarrao | msomeswararao1999@gmail.com |
| **91** | Meesala Rambabu | rambabumeesala870@gmail.com |
| **92** | Milan Bhatt | filcco@gmail.com |
| **93** | Mithilesh Ray | singhmithilesh2002@gmail.com |
| **94** | Mohammed Faisal | faisal@impressionsgroup.in |
| **95** | Monika Vashisht | reportsidsppunjab@gmail.com |
| **96** | Mritunjoy Roy | mritunjoy.roy@gmail.com |
| **97** | Mukesh Choudhary | mukeshchoudhary@impressionsgroup.in |
| **98** | N.Balakrishnan | drbalanicd@gmail.com |
| **99** | N.Krishnasamy | krish_bhuvana@yahoo.co.in |
| **100** | Nageswar Rao Veruva | nrveruva@gmail.com |
| **101** | Nandan Khamkar | Nandan.khamkar@gmail.com |
| **102** | Navjot Kaur | Punjab.idsp@gmail.com |
| **103** | Navneet Sharma | pcaspvtltd@gmail.com |
| **104** | Neena Singla | neenasingla@pau.edu |
| **105** | Nishant sinha | nishantsinha9@gmail.com |
| **106** | Ovonel | info.ovonel@gmail.com |

| | | |
|---|---|---|
| **107** | Peoples pest control services pvt. Ltd | peoplespest@gmail.com |
| **108** | Port Health Officer ,Chennai | quarantinechennai@yahoo.com |
| **109** | Prakash Sasidharan IPCA | president@ipca.org.in |
| **110** | Praveen Kumar Kathroju | kathroju@gmail.com |
| **111** | Praveen Madala | madala.p@nic.in |
| **112** | Praveenraja Adhidasu | bomchennaic@hvlpestservices.com |
| **113** | Premkumar | pestprem@gmail.com |
| **114** | Pushpalatha crps | pushpalatha.crps@gmail.com |
| **115** | R S Tripathi | drrs_tripathi@yahoo.co.in |
| **116** | Raja Mahendran | raja@pestconsultant.com |
| **117** | Renuka Rani | brenuka@manage.gov.in |
| **118** | Rajendra Patel | shreepestcontrol@gmail.com |
| **119** | Rajesh Singh | rajesh@pccsi.in |
| **120** | Rakesh Kr Singh | rakesh_kumar.singh@syngenta.com |
| **121** | Reeta Mehta | dpcpestcontrols@gmail.com |
| **122** | Rina Tilak | rinatilak@hotmail.com |
| **123** | Rishi Agarwal | rishi_agarwal1@yahoo.com |
| **124** | Riyazat | riyazat.alikhan@gmail.com |
| **125** | R Vasudev | rvasudev35@gmail.com |
| **126** | S Balamurugan | sbala.net@gmail.com |
| **127** | Sai sandeep | pendramonisandeep@gmail.com |
| **128** | Satish tyagi | satishtyagijpr@gmail.com |
| **129** | Seema Sharma | seemaento@gmail.com |
| **130** | Shiva Shanker | services@extracarepc.com |
| **131** | Shivadatt Pachouri | jaipur.branch@pestbugbuster.com |
| **132** | Sikendra Kumar | sikendrakumarnna@gmail.com |
| **133** | Sivakumar | president@pmpwam.org |
| **134** | Soumya bairagya | samaresh84401@gmail.com |
| **135** | SPCCHH Meghalaya | spcchhmegha17@gmail.com |
| **136** | State entomologist Rajasthan | jyotigoyal1985@gmail.com |
| **137** | Sudesh Deshmukh | sudeshdeshmukh77@gmail.com |
| **138** | Sudhir | info@arbudaagroheicals.com |
| **139** | Suresh Kumar | suresh.kumar@pestcontrolindia.org |
| **140** | TP Rajendran | tp.rajendran@yahoo.co.in |
| **141** | U K Pestman | ukpestman@gmail.com |
| **142** | Uday Menon | udaymen@gmail.com |

| | | |
|---|---|---|
| **143** | V Sunitha | vanamsunitha10@gmail.com |
| **144** | Vasanthakumar | vasanthkutyma@gmail.com |
| **145** | Veloore yamini | velooreyamini22@gmail.com |
| **146** | Vidhi | vidhiaapl@gmail.com |
| **147** | Vijeta Prajapati | vijetaprajapati1234@gmail.com |
| **148** | Vinodh B | vino251083@yahoo.com |
| **149** | Vishal R Bhutada | vishal.bhutada@hotmail.com |
| **150** | Zualtei Kawilam | zualteikawilam26@gmail.com |

**Annexure- II**

Webinar on

Safe and Effective Use of Non-Toxic Rodent Management Methods

for the Control of Rats and Mice in Human Habitations

29th September, 2021

## Program Schedule

| Time | Session | Resource person | Address with e mail |
|---|---|---|---|
| **1000 hrs** | **Registration of participants** | | |
| **1030 hrs** | **Inaugural session** | | |
| | Introduction to Webinar | Dr. B. Renuka Rani | Dy. Director(NRM)<br>MANAGE |
| | Expected outcomes | Dr. A.M.K.Mohan Rao | Member, Vector Control Working Group for Asia, TPH Switzerland, Former Joint Director, VPM, NIPHM, (DAC, MoAFW) Hyderabad<br>mohanrao.arasada@live.com |
| | Inaugural address | Dr. RS Tripathi | Former Project Coordinator<br>ICAR-AINP on Vertebrate Pest Management, Jodhpur<br>drrs_tripathi@yahoo.co.in |
| **1110 hrs** | Commensal rodents: their impact in human habitatations and habitat analysis | Dr. A.M.K.Mohan Rao | |
| **1135 hrs** | Role of rodents in spread of human diseases | Dr S.N. Sharma, | Consultant, NCDC, & Former Joint Director, NVBDCP (MoHFW), Delhi<br>drsns.nvbdcp@gmail.com |
| **1200 hrs** | **Tea Break** | | |
| **1210 hrs** | Mechanical practices in rat and mouse management – Rat guards, sealing materials, snap and live traps, metal sheets etc | Dr. N. Srinivasa Rao | Senior Scientist, ICAR - AINP on VPM, Regional. Agric. Res. Station, Maruteru, A.P<br>raoento@yahoo.co.in |
| **1250 hrs** | Environmental management as a tool to rodents' source reduction control | Dr. Elton Rogozi, | Entomologist cum Rodentologist, Inst. Public Health, Albania<br>eltonrogozi@yahoo.com<br>erogozi@hotmail.com |

| | | | |
|---|---|---|---|
| **1320hrs** | Rat and mouse control activities in Srilanka | Mr. Raja Mahendran | International Pest Control Business Manager,<br>Colombo, Sri Lanka<br>raja@pestconsultant.com |
| **1320 hrs** | **LUNCH BREAK** | | |
| **1400 hrs** | Rodent burrow smoking – an effective way for control | Dr. N. Srinivasa Rao | |
| **1420 hrs** | Constraints in rat and mouse management and remedial measures | Dr. A.M.K.Mohan Rao | |
| **1445 hrs** | Achievements of community actions in Andhra Pradesh | Mr. V.D. V. Kripadas/<br>Mr. Jaya Kumar | Joint Director of Agric., Inputs, Govt of Andhra Pradesh, Amaravathi<br>vdvdas1@yahoo.co.in |
| **1505 hrs** | Regulatory issues with inputs concerning rat and mouse control | Dr. T.P. Rajendran | Former Asst. Director General, PP & BS, ICAR, New Delhi & OSD-Director, Natl Inst. Biotic Stress Mgmt., ICAR, Raipur<br>tp.rajendran@yahoo.in |
| **15.25 hrs** | Supplementary information - y<br>Botanicals, repellants against rats n mice<br>Sticky tape to prevent rat climbing coconut trees | Dr. Neena Singla<br><br><br>Dr. Mani Chellappan | Head, Zoology Deptt, Punjab Agril. University, Ludhiana<br>neenasingla1@rediffmail.com<br><br>Head, Entomology Deptt. Kerala Agril University, Thrissur<br>manichellappan@gmail.com |
| **1550 hrs**<br><br>**1610 hrs**<br><br>**1635 hrs** | Remarks and discussion by Pest Management Industries | Mr. Prakash Sasidharan<br><br>Mr. Sarang Savalekar<br><br>Mr. Siva Kumar | President, IPCA, Mumbai<br>president@ipca.org.in<br><br>President, PMA, Pune<br>pmaindia08@ymail.com<br><br>President, PMPWA, Mumbai<br>president@pmpwam.org |
| **1700 hrs** | **Valedictory Session**<br>Closing remarks<br><br>Way forward<br><br>Vote of thanks | <br>Dr. R.S. Tripathi<br><br>Dr. A.M.K. Mohan Rao<br><br>Dr. Renuka Rani | Former Project Coordinator, ICAR-AINP on VPM, Jodhpur<br>drrs_tripathi@yahoo.co.in<br><br><br>Deputy Director, MANAGE |


**National Institute of Agricultural Extension Management (MANAGE)**
(An Autonomous Organization of Ministry of Agriculture & Farmers Welfare, Govt. of India)
Rajendranagar, Hyderabad-500030, Telangana, India
www.manage.gov.in