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RODENT
Newsletter

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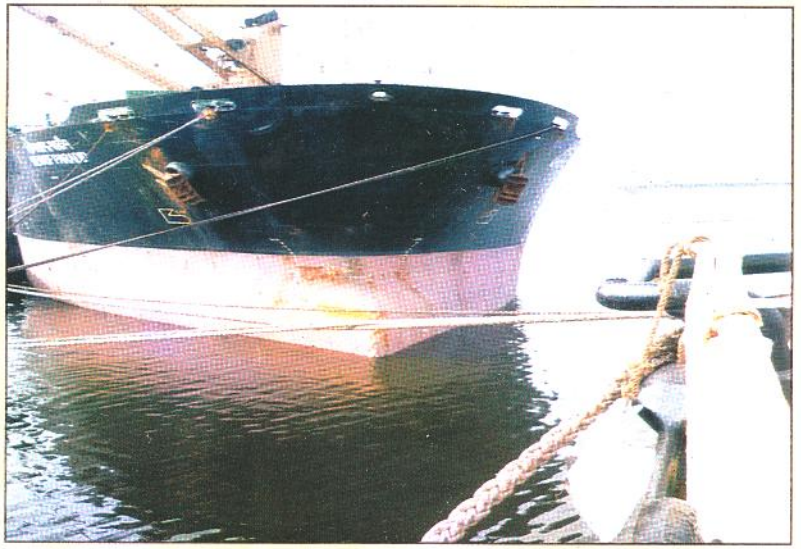
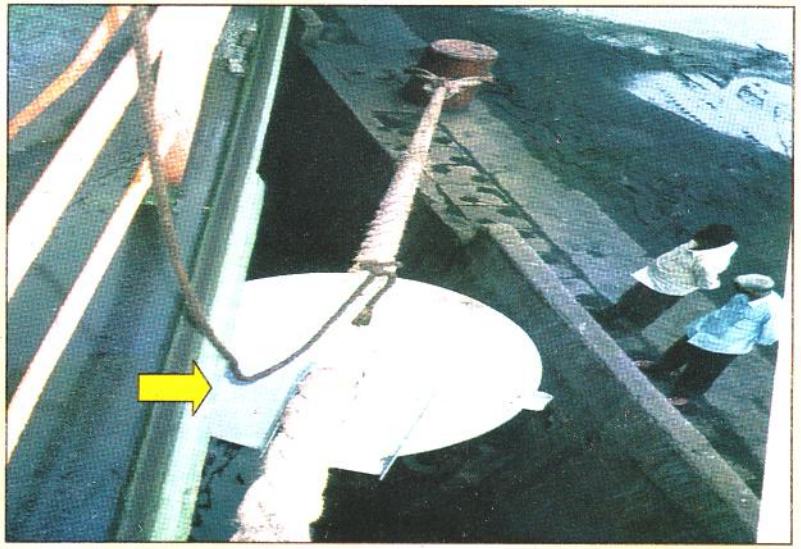
All India Network Project On Rodent Control
Central Arid Zone Research Institute
Jodhpur - 342 003, India

RAT GUARDS – TO CHECK RODENT ENTRY INTO SHIPS



Ship without any Rat guards



Rat Guard on Mooring ropes

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AINP on Rodent Control
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Rodent Surveillance and Prevention of Rodent Borne Diseases in the Context of International Health Regulations-2005 in International Sea Ports in India

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Rodents are among the most important competitors with human for food and shelter and are therefore responsible for damaging and destroying more than 42 million tons of food worldwide. Besides being a serious problem to our food production and storage they are a major threat to public health. They destroy approximately 10 times more than what they actually eat by contaminating the stored products through urination and defecation. Rodents can transmit more than 31 diseases (ricketsial, bacterial, fungal, protozoan, nematode, arthropod and viral disease) to human beings. These tiny vertebrates are also reported to transmit 11 documented and 12 non documented hanta virus diseases; however no indigenous transmission of Hanta virus has been reported from India so far. Some important diseases of rodents communicable to man are detailed in Table 1. More than 10 million people have died from rodent borne diseases in the past century alone.

Rodent borne diseases are transmitted to human beings either through **(a) Indirect transmission**, where the rodents may act as intermediate hosts for parasites that ultimately infect man or they may serve as reservoirs of disease agents-picked up by arthropod vectors and transmitted to humans through bites or through **(b) Direct transmission**, for example in case of viruses- Hanta viruses, where rodents may transmit the pathogen directly through inhalation of aerosolized excreta, ingestion of excreta or by direct contact with the rodent itself or may directly transmit a pathogen to man through bite-Rat bite fever.

Sea ports receive and manage goods and people from all over the world and therefore, ports are exposed to the risk of introduction of rodent reservoirs and flea vectors from any other part of plague and other rodent

borne diseases endemic countries. The activities undertaken at ports, such as handling of foodstuffs attract many species of vermin. Rodents can gain access to ships directly through mooring ropes, hulls and gang ways. Rodents may also be concealed in cargo, ship's stores along with other materials taken on to the ship. Contaminated international vessels transport rodent borne diseases across geographical boundaries.

Table 1. Some of the important rodent borne diseases communicable to man

Name of Diseases	Etiological agent	Usual method of Human infection
1.Rickettsial		
1.Scrub Typhus	*Rickettsia tsutsugamushi*	Mite bite
2. Murine Typhus fever	*Rickettsia mooseri*	Flea-bite
Bacterial		
1.Rat bite fever	*Spirillum minus*	Rat bite
2.Leptospirosis	*Leptospira icterohaemorrhagiae*	Through skin abrasion
3. Plague,	*Yearsinia pestis*	Flea bite
4. Psudotuberculosis,	*Pasteurella pseudotuberculosis*	Unknown
5. Relapsing fever	*Spirochaetes genus Borrelia*	Tick bite
6.Salmonella infections	*Salmonella sp.*	Eatables infected with rat droppings
7.Tularaemia	*Bacterium tularensis*	Skin abrasion or tick bite
Fungal		
1. Sporotrichosis	*Sporo trichum schenckii*	Animal bites
2. Histoplasmosis	*Histoplasma capsulatum*	Contact
3. Ring Worm	*Trichophyton mentagrophytes*	Contact
Protozoan		
1.Amoebiasis	*E.histolytica*	Contaminated food
2.Toxoplasmosis	*Toxoplasma sp.*	Unknown
3.Sarcocystiasis	*Sarcocystis sp.*	Contaminated food
Nematode		
1.Trichinosis	*Trichinella spiralis*	By mouth
Cestode		
1.Echinococcosis(Hydatid)	*Echinococcus granulosis*	Contaminated food
Trematode		
1.Lung fluke disease	*Paragonimus kellicotti P. westermani*	Infected food
2.Schistosomiasis	*Schistosoma japonicum*	Through skin
Arthropod		
1.Rat-mite dermatitis	*Bdellonyssus bacoti*	Contact
Viral		
1. Kyasunar Forest Disease	*KFD Virus(Alphavirus)*	Tick bite
2. Lassa fever	*Arenavirus*	-
3. Tick borne encephalitis	*TBE virus*	Tick bite
4. OMSK haemorrhagic fever	*OHF virus*	

Hanta Viruses- 11 (No transmission in India)

The International Health Regulations (IHR)-2005

Prior to 15th June 2007 the Deratting / Deratting Exemption Certificate was the only required sanitary document for international shipping under the International Health Regulations (1969) to help monitor and control four serious communicable diseases that had significant potential to spread between countries. The IHR was adopted by the World Health Assembly in 1969, having been preceded by the International Sanitary Regulations adopted by the Fourth WHA in 1951. The 1969 Regulations, which initially covered six "Quarantinable diseases" were amended in 1973 and 1981, primarily to reduce the number of covered diseases from 6 to 3 (Yellow fever, Plague and Cholera) and to mark the global eradication of Small pox. In consideration of the growth in international travel and trade, and the emergence or re-emergence of international diseases threats and other public health risks, the International Health Regulations (2005) were adopted by the 58th World Health Assembly on 23 May 2005 which came into force on 15th June 2007. The purpose and scope of these Regulations are to prevent, protect against, control and provide a public Health Response to the international spread of the diseases in ways that are commensurate with and restricted to public health risks, and which avoid unnecessary interference with international traffic and trade.

All vessels arriving from a foreign ports must have a Ship Sanitation Control Certificate (Deratting Certificate) issued by a designated approved port, showing that the ship has been deratted within previous six months or an Exemption Certificate that it is free from rodents. If the certificate was issued more than six months before, the ship must be inspected at an approved port and, if necessary, be treated to control the rodents and another exemption certificate issued.

IHR in reference to Plague

Surveillance (Human, rodent and fleas) is to be undertaken with quick response and the confirmation of the cases is to be notified to WHO and countries within 24 hrs. Report on newly discovered or reactivated plague foci should be communicated. Appropriate rodent and flea control measures should be undertaken for ships, air crafts and land transports. All ships should be thoroughly checked for rodent activities and ships should be de-ratted immediately if found positive for rodent activities. Sea ports and airports should have rat proof buildings/godowns /stores

etc. to control the rodent activities. International travelers prior to departure from an area (epidemic of pulmonary plague) having significant exposure should be isolated for 6 days after the last exposure. On arrival of an infested ship or aircraft, travelers should be dis-insected and kept under surveillance for 6 days.

Port Health Organization Govt. of India

It is an organization of Government of India that performs a host of statutory duties of National as well as International importance and implementation of IHR-2005 and Indian Port Health Rules in co-ordination with Port Trust officials and shipping agents. The primary objective of the Organization to prevent entry of pathogens responsible for spread of communicable diseases like Plague, Yellow fever, SARS, Avian Influenza, H1N1 etc. in India. Therefore the organization undertakes vector and disease surveillance activities in the sea ports.

Rodent vector surveillance is carried out on board including cargo vessels, passenger vessels, sailing vessels and fishing vessels and also in and around port areas. The activities of the Port Health Organization, like inspection of ports, certificates issued and vessels fumigated/ decontaminated/ deratted etc from 2005-09 is detailed in Table 2.

Table 2. Activities of Port Health Organization at Major sea ports during 2005-09

(A)Number of National and International ships handled / Inspected							
Year	Mumbai	Kandla	Cochin	Marmugao	Tuticorin	Chennai	Kolkata
2005	1874	1725	1241	604	-	1219	2211
2006	1921	1605	1270	644	-	1144	2007
2007	1920	1353	1211	731	214 (from Nov.)	1336	2253
2008	1925	1439	847	754	1494	1304	2405
2009	2410	1939	766	889	1351	1521	2542
(B)Sanitary Exemption Certificate issued							
2005	482	243	277	98	-	151	134
2006	461	309	680	87	-	167	157
2007	487	364	107	117	57	340	182
2008	615	437	303	142	122	302	173
2009	535	393	250	138	142	177	238
(C)Number of Vessels were fumigated/decontaminated/Deratted							
2005	*91	-	19	-	-	Nil	-
2006	*82	-	21	1	-	Nil	-
2007	*41	2	16	-	Nil	Nil	-
2008	*73	17	22	2	5	Nil	-
2009	*20	-	28	-	10	Nil	-

During last few decades, there has been emergence and re-emergence of a number of communicable diseases with potential for rapid international spread. This has necessitated the need to expand and strengthen the disease surveillance facilities at major international air / sea ports in the country catering to the huge international traffic and trade that has increased tremendously in recent years.

Rodent Management in and around port areas

Five rodent species, viz, *Rattus rattus, R. norvegicus, Mus musculus, Bandicota bengalensis* and *B. indica* are main problem in and around seaports. The basic steps for eliminating rodent population in and around port areas include Inspection, Sanitation, Exclusion, Population Reduction (traps, rodenticidal baits, repellents etc.) and Verification. Following recommendations were made for effective rodent management in and around ports.

- Since the Rodent density is very high in the port areas, permanent bait station should be constructed near all the garbage handling areas, canteens, warehouses and residential areas/ hospitals and office premises. Anticoagulants rodenticides may be used in baits on regular basis.
- Rodent trapping and use of mechanical barriers like rat guards at mooring ropes and gangways etc may be advocated for excluding rats from entering the ships.
- Penalty should be imposed for the international vessels for not having rat guards in all the mooring ropes.
- Rodent burrows should be sealed with concrete and mortars in and around of all food godowns and canteens.

Inspection of International Vessels in the context of IHR 2005

NCDC, Plague Surveillance Unit, Bangalore made regular visits to all the international sea ports in India. During the survey of rodent problem at sea ports some of the international vessels were also inspected by Unit in the context of IHR-2005. The validity of the Ship Sanitation Control Exemption Certificate (valid for 6 months for any sea port in the world) was checked along with the Port of Calls and noted the Plague endemic Countries visited by the ship within a month. Placement of rodent guards on all the mooring ropes and Gangways which are supposed to be the easy access for rodents were also inspected. All the public health

workers/sanitary inspectors/health officials with Port Health Organization and Port Trust office and the municipal workers working in the wards adjacent to sea port areas, Health officials from Naval and Coast Guard organizations were imparted training on IHR 2005 and Rodent/ Flea surveillance and control (Table 3).

Table 3. Summary results of surveys on rodent and flea problems in Sea Port areas by NCDC during 2009-10

Sea Port s	No. of rodents collected					No. of fleas collected/ AFI	No. of persons trained
	Rr	*Bb*	*Bi*	*Rn*	Total		
Chennai (T.N.)	48	2	8	-	58	87 (1.5)	258
Marmugao(Goa)	15	-	4	-	19	nil	30
Cochin (Kerala)	44	-	10	-	54	nil	120
Tuticorin (T.N.)	3*	-	-	-	3	nil	145
Visakhapatnam (A.P.)	28	-	4	-	32	nil	19
Kandla (Gujarat)	60	-	74	12	146	174 (0.94)	152
Mundra (Gujarat)	18	-	-	-	18	22 (1.22)	65
Kolkata, (W.B.)	-	-	84	-	84	9	23
Visakhapatnam (A.P.)	54	5	38	5	102	27(0.26)	

Rr: Rattus rattus, Bb: Bandicota bengalensis, Bi: Bandicota indica, Rn: Rattus norvegicus AFI: Absolute Flea Index;

*Density of *Bandicota india* was very high but could'nt be collected.

Save the diversity of Parti-colored Flying Squirrel, *Hylopetes alboniger*

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The parti-colored flying squirrel, *Hylopetes alboniger* (Hodgson, 1836) Family Scuiridae, Order: Rodentia) (Fig. 1) is distributed in Bangladesh; Bhutan; Cambodia; China; Lao People's Democratic Republic; Myanmar; Nepal; Thailand; Viet Nam and India (Fig. 2). In India its distribution is restricted to eastern Himalayan tracts in North Easter Hill region. Although it is seldom recorded This flying squirrel species is listed under category of "Least Concern" because of its relatively wider distribution, presumed larger population and its unlikeliest faster and enough decline to qualify for listing under more 'threatened category'.

The parti-colored flying squirrel, an arboreal rodent with nocturnal habits, is found in tropical and subtropical mountain forests at middle to high elevations (1,500 to 3,400 above MSL). Its populations can be found in primary as well as secondary forests, degraded forests and scrubby habitat. Two to three youngs are born in each litter. There is little information available on the abundance of this species. The population of this species is believed to be declining in South Asia, but the rate of decline is not known. In North-East India, the species is threatened mainly by habitat loss due to small wood plantations and various human activities like, shifting (Jhum) agriculture, infrastructure development, and establishment of human settlements, hunting & trapping of terrestrial animals and fire & fire suppression.

The species is included in the Schedule II (Part II) of the Indian Wildlife Protection Act, 1972. Despite this, the species is hunted for food in certain parts of North-Eastern India. This rare species is known from Namdapha National Park, in Arunachal Pradesh. The smoked (preserved) squirrels is available in local market of Pasighat (Arunachal Pradesh) for sale as a meat.

Fig. 1. The parti-colored flying squirrel, *Hylopetes alboniger*

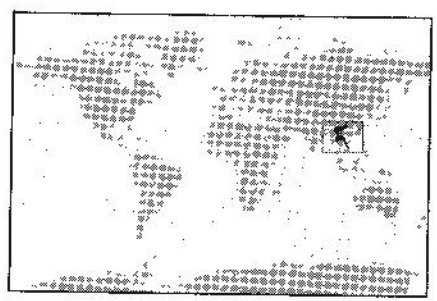

Fig.2.Distribution of *Hylopetes alboniger*

Detailed studies on survey, monitoring, taxonomy, distribution, abundance, general ecology and threats to this species in Southeast Asia are urgently needed to ascertain its status. As it is one of the threatened species, awareness programmes should also be initiated by the Government agencies, NGOs, SHGs, social leaders etc. The school education programme may also include it for creating awareness among students/ youths to save the existence of this beautiful creature of nature.

Effect of fumigation on soil mycoflora in irrigated rice eco-system

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Burrow fumigation with natural smoke and aluminum phosphide (ALP) are found to be one of the best options in managing the rodent population, especially during the reproductive phase of irrigated rice crop in Godawari Delta region of Andhra Pradesh. Aluminum phosphide pellets/ tablets release phosphene, carbon dioxide and ammonia gases upon atmospheric exposure, where as natural smoke from rice straw contains carbon dioxide, carbon monoxide etc. The deleterious effects of burrow fumigation with ALP and rice straw smoke on soil micro organisms was studied at APRRI Research Farm, Maruteru in two crop seasons during kharif 2008 and 2009. Five treatments in five replications, viz., T1-ALP 2 pellets/ burrow; T2-ALP 4 pellets/ burrow; T3-Natural smoke fumigation for 3 minutes; T4-Natural smoke fumigation for 6 minutes and T5-Control) were imposed 75 days after transplanting in the rodent burrows of rice field bunds. The Alp pellets weighing 0.6 g with a.i.56% were used in the trials. Soil samples were collected at 1 day before, 1 and 7 days after fumigation in each treatment. The collected soil samples were shade dried, powdered and sieved. The processed soil samples were extracted / filtered with distilled water and serially diluted and incubated on Potato Dextrose Agar Medium to observe the growth of various mycoflora. The colonies of mycoflora were counted and compared with the control treatment.

Among the 17 fungal species recorded in all the treatments, Aspegillus niger, A. flavus, Penicillium sp., Trichoderma viride, Trichoderma sp., Rhizopus sp. etc were the dominant species (Table 1). Soil mycoflora varied in their response to both the treatments. Maximum reduction in colony forming units of A. flavus was recorded in rice straw smoke fumigation for 3 minutes followed by ALP @ 4 pellets/ burrow in contrast to increase in the control. Reduction in the population of Trichoderma species was significant in smoke fumigation treatments. However, ALP @ 2 pellets/ burrow was found to have no influence on the Trichoderma sp. population. Smoke fumigation reduced the colonies of A. niger, whereas,

it was remained unchanged in ALP treatments. In general, smoke fumigation had negative effect on soil mycoflora. The growth of soil mycoflora colonies were reduced by 60% in smoke fumigation treatments, whereas it was increased in ALP and Control treatments (Table 2).

Table 1. Influence of ALP and Paddy straw smoke fumigation on soil mycoflora in irrigated rice ecosystem

S. N.	Fungal species	Colony forming units (CFU)														
		ALP (2 ellets/burrow)			ALP (4 ellets/burrow)			Smoke (3min)			Smoke (6min)			Control		
		1 DBT	1 DAT	7 DAT	1 DBT	1 DAT	7 DAT	1 DBT	1 DAT	7 DAT	1 DBT	1 DAT	7 DAT	1 DBT	1 DAT	7 DAT
1	*A.flavus*	2	1	1	3	0	1	2	0	0				0	0	2
2	*A.niger*	2	4	2	2	6	2	9	2	1	8	4	0	11	14	8
3	*T.viride*	3	1	6	12	7	3	-	-	-	14	3	1	0	0	2
4	*Penicillium* sp	-	-	-	0	0	3	-	-	-	-	-	-	-	-	-
5	*Aspergillus* sp (3 species)	-	-	-	4	0	0	0	3	2	3	2	9	5	5	0
6	*Rhizopus* sp.	-	-	-	-	-	-	4	3	0	4	2	0	7	0	0
7	*Trichoderma* sp (2 species)	5	14	7	-	-	-	3	3	4	4	0	0	17	15	19
8	Unidentified fungal species+	68	73	65	16	22	38	74	26	29	69	29	28	32	52	67
9	Total no. of colonies	80	93	81	37	35	47	94	37	36	102	40	38	72	86	98
10	Total no. of fungal sps. observed	17			13			15			16			11		

Table 2. Effect of Smoke and ALP fumigation on soil mycoflora

S. No.	Treatments	% Increase (+)/ reduction (-) in the CFU of soil mycoflora	
		1 DAT	7 DAT
1	ALP (2 Pellets /burrow)	16.25	1.25
2	ALP (4 Pellets /burrow)	-5.41	27.03
3	Paddy straw Smoke (3min)	-60.64	-61.70
4	Paddy straw Smoke (6 min)	-60.78	-62.75
5	Control	19.44	36.11

Rodent pest management module in wheat crop sown with Happy Seeder under rice residue management

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Rice-wheat is the major cropping system of Punjab. Cultivation of high yielding varieties of rice and wheat has resulted in the production of huge quantities of crop residues. At present, while more than 75% of wheat residue is collected by the farmers and fed to animals, paddy straw is considered poor feed for animals due to its high silica content. Burning is the normal method of paddy straw management which has serious effects on soil fertility due to loss of nutrients and organic matter; human and animal health due to air pollution and greenhouse gas emissions resulting in great damage to the environment. To mitigate this problem, a new machine called as 'Happy Seeder' capable of direct drilling wheat into heavy rice residue loads by managing the part of straw coming in front of furrow openers has been developed by Punjab Agricultural University, Ludhiana. Due to such type of action of this machine, the rice straw is spread on the surface which acts as source of food and shelter for rodents leading to higher rodent infestation and damage in such crops compared to the crops sown with conventional tillage. Two rodenticide treatments, i.e. burrow baiting with 2% zinc phosphide after sowing of wheat crop in the month of October followed by grid baiting with 0.005% bromadiolone during the months of February-March at two locations (village Hissowal, Distt Ludhiana and village Kanoi, Distt Sangrur) resulted in total saving of the crop from rodent damage (Table 1).

Similarly, two rodenticide treatments i.e. burrow baiting with aluminium phosphide in the month of October followed by grid baiting with 2% zinc phosphide during the months of February-March at two locations (KVK Kheri, Distt Sangrur and KVK Fatehgarh Sahib, Distt Fatehgarh Sahib) also resulted in total saving of the crop from rodent damage (Table 1). However, single treatment i.e. burrow baiting with 2% zinc phosphide in the month of October in village Mundrawala and no treatment in village Macchiwala of Distt Amritsar in wheat crops sown with Happy Seeder revealed rodent damage up to 0.28 and 4.19%,

respectively (Table 1). Based on these results, for rodent pest management in wheat crops sown with Happy Seeder it has been recommended to conduct two rodenticide baitings, first with burrow baiting after sowing of crop in the month of October and second with grid baiting in the months of February-March.

Table 1. Rodent damage in wheat crop sown with Happy Seeder under rice residue management

District	Village	Treatment	% cut tillers	Yield loss (Kg/0.4 ha)
Ludhiana	Hissowal	DT (ZnP + Br)	Nil	Nil
Sangrur	Kanoi	DT (ZnP + Br)	Nil	Nil
	KVK, Kheri	DT(AF + ZnP)	Nil	Nil
Fatehgarh Sahib	KVK, Fatehgarh Sahib	DT(AF + ZnP)	Nil	Nil
Amritsar	Mundrawala	ST (ZnP)	up to 0.28	up to 1.58
	Macchiwala	UT	up to 4.19	up to 126.08

ST-single treatment, DT-double treatment, UT-untreated, ZnP-2% Zinc phosphide, Br-0.005% bromadiolone, AF-Aluminium phosphide

Antifeedant property of Neem bark and *Calotropis* latex against house rat, *Rattus rattus*

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Commensal rodents like house rats, *Rattus rattus* share environments with humans and other mammals, therefore usage of toxic rodenticides for their management poses potential risks to non-target animals including human beings. Presently greater stress is being laid on the exploring the possibility of using botanicals for rodent management rather the toxic chemicals, as these plant based formulations are effective, less costly and eco-friendly. In the present study two plant based formulated baits i.e WSO-mix (wheat, sugar and refined oil, 96:2:2) having neem bark powder mixed @ 0.5, 1.0 and 5.0% and latex of *Calotropis procera* mixed in WSO-mix bait @ 1.0, 3.0, 5.0 and 7.0% were tested for their antifeeding property against house rats. Seven different sets of house rats (having three male and three female in each) were exposed to control bait (WSO

mix) and treated baits placed in two different feeding bowls in laboratory cages under bi choice conditions for four days. For the purpose two cages (36cm x23cm x 23cm) were joined together so that rats had access to both the bowls with sufficient area of exploration and development of choice for feeding. To avoid place preference on feeding, the position of food bowls was altered daily. Consumption of treated and untreated bait (g/100g body weight) by rats was recorded after every 24 hours. Antifeeding index (%) was calculated using the formula;

$$\text{Antifeeding Index (\%)} = \frac{\text{Consumption of untreated bait} - \text{Consumption of treated bait}}{\text{Consumption of untreated bait}} \times 100$$

The results revealed that antifeeding index of neem bark treated baits increased with the increase of its concentration i.e., 16.50, 29.31 and 76.66%, respectively at 0.5, 1.0 and 5.0% treated baits. In case of *Calotropis* latex treated baits, antifeeding index was 31.27% at 1%, which increased to 41.95% at 3% concentration; however there was decline to 23.41 and 14.03% on increasing the latex concentrations to 5 and 7%, respectively in baits (Fig. 1).

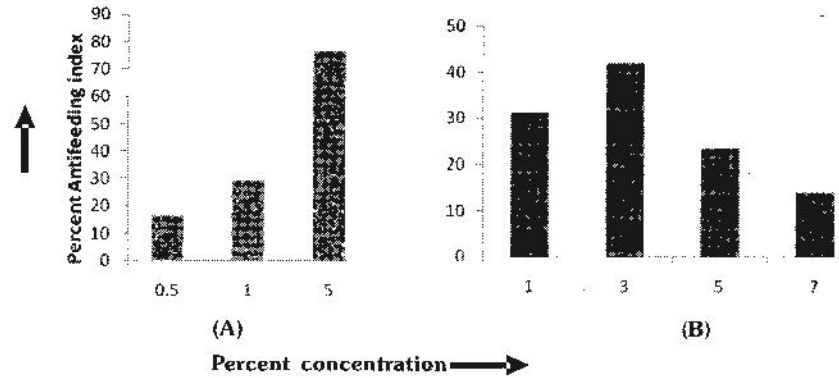

Fig. 1. Antifeeding index of neem bark (A) and *Calotropis procera* latex (B) against house rat, *Rattus rattus*

Out of these two tested botanical based formulated baits, neem bark powder at 5% yielding highest index of 76.66% may be regarded to possess efficient anti feedant properties against house rats however its potential for management of house rats needs further studies under commensal situations.

New Records of Rodent Species Andaman

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The Andaman and Nicobar group of Islands forms an arched string of 572 Islands and islets stretching from Burma in the north to Sumatra in the south. The collections of rodents were made from fields, houses, shops and godowns as well as from poultry/animal farms. These samples were sent to Zoological Survey of India, Kolkata for proper identification. A total of 18 rodent species has been identified: out of them 3species are new records from Andaman Island. From that collection, little Indian field mouse (*Mus booduga*), Asian House Rat (*Rattus tanezumi andamanensis*) and Cutch rock rat (*Cremnomys cutchicus*) were reported as new species from Andaman Islands.

The Little Indian field mouse (*Mus booduga*) belongs to a species of rodent in the Muridae family. It has been found in Andaman Island. The little Indian field mouse found in evergreen tropical forests and cultivated lands of Andaman Islands are also grey in body color like elsewhere. All the specimens were collected from Garacharma location of South Andaman. The main plantation crop found at Garacharma location are areca nut, coconut and cashew. These suitable features adapted for residential purpose as well as cultivation, increases the availability of food to rodents and proved to be a suitable habitat for rodents. Their body weight ranged from 9.6-10.1g. Their head, body and tail length ranged from 1.5-2.2 cm, 4.6-5.2 cm and 7.0-7.4 cm, respectively, The Asian House Rat (*Rattus tanezumi andamanensis*) was found in many man-made habitats including agricultural and wholly urban areas, it is a supremely adaptable species. It is omnivorous, feeding on all manner of farmyard waste and food scraps. The species is closely related to the European House Rat, *Rattus rattus*, but recent studies suggest it to be a separate species. *Rattus tanezumi* (Asian house rat) is abundant in Asia including the Indonesian Archipelago. It has been found in Andaman Island also. Their body weight ranged from 118.0-170.0 g. Their head, body and tail length ranged from 3.5-5.1 cm, 10.2cm-14.5 cm and 14.7-20.5 cm respectively. Tanezumi rat consumes and hoards more areca nutus. The cutch rock rat, *Cremnomys cutchicus* is discontinuously distributed in India but it was not found in Andman. Their body weight ranged from 20.1-23.8 g. Their head body and tail length ranged from 3.8-4.0 cm, 6.3-6.8 cm and 9.8-10.1 cm respectively.

(Courtesy: Souvenir and Abstract: 9th National Symposium on 'Crop Health Management for Sustainable Agri-horticultural Cropping Systems; CARI, Port Blair (Feb 17-19, 2011).

RECENT PUBLICATIONS

(Compiled by Dr Neena Singla, Punjab Agricultural University, Ludhiana-141 004)

Brown PR and Khamphoukeo K. 2010. Changes in farmers' knowledge, attitudes and practices after implementation of ecologically-based rodent management in the uplands of Lao PDR. *Crop Protection* 29: 577-582.

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Chaudhary, V. and Tripathi, R.S. 2010. Incidence of rodent pests in cumin (*Cuminum cyminum* L.) and their management. *Journal of Horicultual Sciences*. 5: 64-67.

Hacquemand R, Pourie G, Jacquot L and Brand G. 2010. Postnatal exposure to synthetic predator odor (TMT) induces quantitative modification in fear-related behaviors during adulthood without change in corticosterone levels. *Behavioral Brain Research* 215: 58-62.

Jacob J, Sudarmaji, Singleton GR, Rahmini, Herawati NA and Brown PR. 2010. Ecologically based management of rodents in lowland irrigated rice fields in Indonesia. *Wildlife Research* 37: 418-427.

Kimball BA and Taylor JD. 2010. Mammalian herbivore repellents: tools for altering plant palatability. *Outlooks on Pest Management* 21: 181-187.

Mulungu LS, Ngowo VD, Mukandi RH, Massawe AW and Leirs H. 2010. Winning the fight against rodent pests: Recent developments in Tanzania. *Journal of Biological Science* 10(4): 333-340.

Naz S, Rana SA, Javed M and Rehman K. 2010. Effect of Two Different Rodenticides on Serum Biochemistry of House Rats (*Rattus rattus*). *Pakistan Veterinary Journal* online available at www.pvj.com.pk

Omudo EA and Ati TT. 2010. A survey of rats trapped in residential apartments and their ectoparasites in Makurdi, Nigeria. *Research Journal of Agriculture and Biological Sciences* 6(2): 144-149.

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Singla N and Parshad VR. 2010. Efficacy of acute and anticoagulant rodenticide baiting in sugarcane fields of Punjab, India. *International Journal of Pest Management* 56(3): 201-210.

Singleton GR, Belmain SR, Brown PR, Aplin KP, Htwe NM. 2010. Impacts of rodent outbreaks on food security in Asia. *Wildlife Research* 37: 355-359.

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Sriniwas Rao, N and Nanda Kishore, M. 2010. Evaluation of Trap barrier System for the management of lesser bandicoot rat, bandicota bengalensis in irrigated rice. *Ind. J. of Plant Protection* 38 (2): 193-196.

Witmer G, Eisemann JD, Hall P, Avery ML and Duffiney A. 2010. Challenges and unique solutions to rodent eradication in Florida. *Proceedings of the Vertebrate Pest Conference* 24: 23-28.

Witmer GW and Proulx G. 2010. Rodent outbreaks in North America. In: Singleton GR, Belmain SR, Brown PR and Hardy B (eds). *Rodent outbreaks: ecology and impacts*. pp 253-267. International Rice Research Institute, Los Banos, Philippines.

Witmer GW, Snow NP and Burke PW. 2010. Evaluating commercially available rodenticide baits for invasive Gambian giant pouched rats (*Cricetomys gambianus*). *Crop Protection* 29: 1011-1014.

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SENSITIZATION WORKSHOP ON RODENT PEST/VECTOR PROBLEMS AND THEIR MANAGEMENT AT NIPHM, HYDERABAD (May 30-31,2011)

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

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