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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

Apex level training programme on Rodent Pest Management at MARUTERU (AP) February 25-28, 2004

Dr. Guo Cong (left), Dr. A.M.K. Mohan Rao (centre) and Mr. Tu Jianhua (right) at Edouard Saouma Award Presentation Ceremony

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AINP on Rodent Control
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FEATURE ARTICLE

SOIL ECOLOGY AND RODENTS

Structural, physical and chemical properties of soils along with biotic factors and their inter-relationship determine the distribution and abundance of fossorial rodents to whom the burrows provide a relatively stable microclimate, suitable breeding site and protection from weather extremes and predators. There exists a species-specific relationship of energetic expense of burrowing and burrow architecture (length, depth and diameter) which in turn depends upon the species' biological requirements and soil properties like texture, moisture, aeration and chemical composition. Soil ecology is the major factor influencing the selection of site for burrowing and that determine the spatial pattern of distribution and abundance of different species of rodents.

Often the rodents dig elongated, deep and complex burrows in clay and loamy soils which persist longer whereas, burrows in sandy soils are less deep and complex because of the limited stability and integrity of their tunnels and chambers. Compact and rocky soils reduce burrowing whereas, soils composed of particles and grains and soft enough for digging facilitate easy burrowing. Desert soils are sandy in texture and mineral in character and thus suitable for certain species of rodents.

Study of the distribution and abundance of rodents in different agroecosystems under the All India Coordinated Research Project on Rodent Control of the ICAR, New Delhi has generated important information of the relationship of soil ecology and rodent burrows. The lesser bandicoot rat, *Bandicota bengalensis* digs elaborate burrows in medium clay and loamy soils with considerable moisture; the short-tailed mole rat, *Nesokia indica* usually digs burrows in soft mesic soil with high moisture contents usually on dykes; the large bandicoot rat *Bandicota indica* dig burrows in humid soils near water bodies, ponds and marshy areas; the desert gerbil *Meriones hurrianae* digs extensive burrows in sandy and

gravel plains, sand dune and interdune areas in arid and semi arid conditions; the Indian gerbil *Tatera indica* digs burrows in gravel, rocky and sandy soils in arid and sub humid habitats; the hairy footed gerbil *Gerbillus gleadowi* digs simple burrows in sand dunes and uncultivated, sandy dry patches; the soft furred field rat, *Rattus meltada* digs shallow and simple burrows in sandy and loamy soils with considerable moisture; *Mus platythrix* burrows in sandy and gravel plains; field mouse, *M. booduga* also prefers sandy soils for burrowing whereas, the house mouse, *M. musculus* burrows in wide variety of soils. Chemistry of soil may have definite effect on burrowing by rodents as *R. meltada* withstand alkaline soil conditions where other species are generally absent.

Agricultural soils are dynamic and undergo changes in their texture and chemistry with changes in agronomic and cropping practices, thus influencing the distribution and abundance of rodent pest species. Drastic changes occurred in soil properties with intensive agricultural practices including increased irrigation during the period of Green Revolution. These changes altered the pattern of distribution of rodents in different parts of India. Rice-wheat rotation caused replacement of *R. meltada* and *T. indica* with *B. bengalensis* which is now predominant in Indo-Gangetic plains.

Knowledge of the relationship of soil properties and infestation rate of rodents is important for planning the control operations as soil texture and chemistry may act as natural deterrent for certain species. Control measures like rodenticide baiting can be concentrated in those soil types which are preferred by the pest species instead of wide-spread applications.

By:

V.R. Parshad, PAU. Ludhiana and
R.S. Tripathi, CAZRI, Jodhpur

Body marking with urine of opposite sex and self-grooming in *Bandicota bengalensis*

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Urine is an important source of semiochemicals involved in mediating physiological functions related to reproduction and behavioral instructions within the same and opposite sex conspecifics of rodents. The physiological effects of urinary pheromones include puberty acceleration and delay, oestrous induction and acceleration, pregnancy block and behavioral effects include marking territory, kin recognition, social and sexual interactions as shown previously in several species of mammals including rodents. During the present studies on the lesser bandicoot rat, *Bandicota bengalensis*, we observed a sequence of behavioral acts culminating in body marking with urine of opposite sex followed by increased rate of self-grooming. Adult *B. bengalensis* were exposed to 0.1 ml fresh urine of the opposite sex in a glass cavity in choice to 0.1 ml distilled water in another glass cavity within the residential cages of each rat individually. The rats after sniffing licked the urine and then applied it on an area (1X3 cms size) on either sides of rump extending towards thigh. The marked area become wet as a result of the application of urine possibly mixed with some saliva. Body marking with urine on the rump and thighs were immediately followed by grooming involving cephalocaudal progression of rhythmic movement of the paws around the mouth and face descending to ventrum and the anogenital area and tail. They were mostly seen to use nasal tips/lips rubbing and combing the hair on the rump and thighs and other part of the body. It was observed that the male and female rats distributed the urine of their opposite sex around their bodies by frequent rubbing and combing of hair and self grooming.

The significance of the unique behavioral acts of *B. bengalensis* as observed during the present studies is not clear, as occurrence of such a behaviour under natural conditions is not yet documented. However, anogenital sniffing is common in *B. bengalensis* during which process the rats of both the sexes sniff the anogenital region of the opposite sex. The sniffing and licking of urine followed by frequent movement of nasal tips and lips on the marked area of the body may be associated with the use of vomeronasal organ, which is a specialized sensory structure for receiving semiochemicals, for detection and transmitting urinary pheromonal information to the olfactory region of the brain. Vigorous self grooming after body marking with urine of the opposite sex may be a strategy adopted by the rats to either expose the vomeronasal organs to urinary semiochemicals for longer period and /or may be related to courtship and mating behaviors in rats. It seems that the urinary pheromones of opposite sex when applied to own body of the recipients by themselves may elicit physiological events relating to maturation, courtship and mating or may be related to communicating certain information to their conspecifics related to these functions. With self grooming rodents are also known to communicate with their conspecifics and the groomers may also stimulate their own reproductive physiology. Enhanced grooming after the application of urine of opposite sex may be related to arousal of courtship and mating events in *B. bengalensis*. Further studies are being carried out to study this strange behavioral phenomenon observed for the first time in the lesser bandicoot rat.

Vole problem and its management in Armenia

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Armenia, a South-western Asian country, east of Turkey with an area of 29,800 sq km has 17.52% arable land with 2.3% area under permanent crops and irrigated area of 2,870 sq. km. Around half of the population depends on agriculture. Wheat and barley are grown as major cereal crops in Armenia. These crops are vulnerable to rodent attack, especially by voles. The surrounding uncultivated lands and annual crops like alfalfa in orchards makes the vole problem perennial to the country. The Ministry of Agriculture recorded active burrows upto 657 per hectare. Common vole, *Microtus arvalis* is a major pest. The voles live in burrow complexes with surface runways for movement and feeding. Orchards with alfalfa inter-cropping are more affected by these voles. Their exploratory activity leaves abundant number of burrows interconnected with each other in the field, although the size of the colony may be solitary or few.

During Spring, 2003 an area of 52,124 ha was affected out of 62,290 ha and in autumn, 2003 an area of 54,728 ha was affected out of 67,031 ha by voles. The Department of Agriculture anticipated that the

affected area may further increase after the winter and during spring season of 2004. With respect to vole management measures, only population reduction technique with ethyl phenacine, an indandione anticoagulant has been used by the Government so far. It is applied directly in the field, affecting the palatability of the baits by the voles and exposing to other environmental hazards.

During December 2003 the situation was reviewed in a 3-day National Workshop on Rodent Pest Management organised at Tsakhkadzor by the author as FAO Consultant and following observations were made:

- Ecological based rodent management technology requires popularization among officials as well as farming community.
- The indices of rodent's viz., trap index, burrow count and relevant biology data on autopsy are all required for forecasting rodent situation.
- Baiting techniques require refinement.

Having drafted a curriculum for Training of Trainers (TOT) on Rodent Pest Management at the National workshop, the consultant organized a TOT for 15 Extension and Plant Protection specialists of Ministry of Agriculture and Marzes at Yerevan from 12-18, December, 2003. The basic methodology of the TOT was participatory and skill development oriented.

Following recommendations were made for a long-term effective vole management :

- Priority should be given for fine-tuning the existing technology in the country during 2004 collaborating with different organizations. Such activities should focus on ecological based vole management measures.
- The Ministry of Agriculture may initiate appropriate action for systematic and planned surveillance activities using EPPO method covering all Marzes in the country.
- The policy of using only ethylphenacin requires revision. Different rodenticides including pelleted zinc phosphide, bromadiolone (a single dose anticoagulant) and other rodenticides may also be considered for use after one-season multilocational trials for their efficacy.
- Farmers' Field Schools (FFS) may be considered in the vole-infested areas due to farmer centric approach and community mobilization.
- In view of seriousness of the situation in Armenia, FAO of UN may consider extending technical assistance through a regular TCP to the country.

Rodent damage in sugarcane fields at Ladhowal farm, P.A.U., Ludhiana

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Regular monitoring of rodent damage was carried out on monthly basis in sugarcane fields of 1 ha area in triplicate at Ladhowal farm of Punjab Agricultural University, Ludhiana. The crop was sown in the month of February and no rodenticidal treatment was done in the experimental fields. Damage survey was monitored at 10 sites/ha. i.e. five sites in one row and five sites in another parallel row. At each site, 10 plants were selected and number of healthy and cut canes/plant were counted. Burrows of *Bandicota bengalensis*, *Mus* spp and *Tatera indica* were observed on the permanent bunds but not inside the field till the month of August. However, in the month of September, burrows were seen inside the fields also, but there were no cut canes. Cutting of the canes by rodents was observed from mid October onwards. This might be due to the harvesting of nearby paddy fields in October that leads to the unavailability of food and shelter in surroundings causing migration of rodents to sugarcane fields. Mean per cent cut canes in the month of October (2002) was 5.52 which increased upto 42.22 in the month of Feb. 2003. Pre-harvest (March 2003) rodent damage was recorded at 25 random sites, by selecting 10 plants/site whereby mean damage was 45.11 % however, at certain sites especially near burrow complexes the damages was even upto 71.93 per cent (Table1).

Table1. Monitoring rodent damage in Sugarcane fields at Ladhowal farm.

S. No.	Month	Percent cut canes (Mean ± S.E)	Range of percent cut canes
1	October	5.52±2.06	0.00-15.50
2	November	8.29±2.82	0.00-22.79
3	December	12.69±1.89	6.45-28.05
4	January	28.67±4.91	0.00-43.80
5	February	42.22±7.03	0.00-66.30
6	Pre-harvest damage (March)	45.11±5.04	6.25-71.93*

* Near burrow complexes.

A method for quantifying barn owl *(Tyto alba stertens)* prey frequency and biomass

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Earlier studies in Cauvery delta, Tamil Nadu, India on the diet of *barn owl Tyto alba stertens* revealed that it feeds chiefly on rodent pests. A technique for quantifying the diet of barn owl in terms of frequency and biomass is explained in this article. Prey frequency and biomass quantification methods are valuable because the frequency data provide better information on the relative importance of different prey species in the diet. A literature review indicates that there is no published information on these aspects in India. Therefore, a technique of quantifying the prey frequency and biomass is explained here.

In order to compute the mean body weight of barn owl prey, four species of field rodents viz., *Bandicota bengalensis, Millardia meltada, Mus booduga* and *Tatera indica* were trapped alive from fields by burrow digging method, whereas the commensal rodent, *Rattus rattus* and an insectivore, *Suncus murinus* were live trapped from the houses using sherman traps. To quantify the prey frequency and biomass, a pooled diet sample of barn owl (490 prey items from 330 pellets) from five roosting sites located in Mayiluduthurai, was used.

i. Prey Frequency : The frequency was quantified by making pairs of mandibles (left and right mandibles) of small mammals from an analyzed pellet. Each pair of mandibles was taken equivalent to one prey frequency. In the absence of small mandibles, the skulls and pelvic girdles were used for this purpose. The skulls and pelvic girdles of small mammals (rodent or insectivore), birds and amphibians and remains of insects were distinguished and each skull, a pair of pelvic girdles and remains of insects were counted as one prey of the respective categories. After enumerating the respective prey species frequencies in a diet sample, the proportion of each prey species, number of prey consumed by one barn owl per day and mean prey items per pellet were calculated.

ii. Prey biomass : Only the small mammals representatives were considered for prey biomass quantification in the present study, as they constituted 98.2% of total prey composition. The frequency of each species was multiplied by mean prey of that species and the proportion of each

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species biomass in the diet and mean prey biomass consumed by a barn owl per day were worked out. The mean prey weight of six species of small mammals is given in Table 1. Among the six species of small mammals *B. bengalensis* formed a major portion of the barn owls diet, in terms of frequency (39.4) as well as biomass (49.1), followed by *M. meltada* (24.9 and 23.1) (Table 2) suggesting that the predators exert a significant predatory pressure on these rodent pests. In the Cauvery delta these two rodents are the major pests of rice crop. *R. rattus* ranked fourth in terms of frequency, while in terms of biomass is ranked third.

Table 1. Mean body weight five small mammals.

Name of the species	Body weight (g)	
	Range	Mean ±S.D.
B. bengalensis	10-250 (n=142)	81.39±56.55
M. meltada	10-95 (n=153)	60.61±35.85
M. booduga	8-16 (n= 26)	12.33±2.13
T. indica	20-210 (n=47)	101.81±44.79
R. rattus	25-190 (n=51)	98.48±40.92
S. murinus	20-55 (n=23)	39.89±10.77

Table 2. Prey frequency and biomass in diet samples of barn owl.

Prey species	Prey frequency		Prey biomass (g)	Percent of total prey biomass
	Number	Percent	Number x Mean prey weight (g)	
B. bengalensis	193	39.4	193x81.39=15,708.27	49.1
M. meltada	122	24.9	122 x 60.61=7,394.42	23.1
S. murinus	61	12.4	61 x 39.89=2,433.29	7.6
R. rattus	58	11.8	58 x 98.48=5,711.84	17.8
Mus sp.	55	11.2	55 x 12.33=678.15	2.1
T. indica	01	0.2	01 x 101.81=101.81	0.3
Total	**490**	**100.0**	**32,027.78**	**100.0**

Prey frequency

Number of prey consumed by 10 barn owl/day = 490/30 = 16.33 prey

Number of prey consumed by 1 barn owl/day = 16.33/10 = 1.63 prey

Mean prey items/pellet = 490/330 = 1.48 prey

Prey biomass

Mean prey biomass consumed by 10 barn owl/day = 32,027.78/30 = 1067.6 g

Mean prey biomass consumed by 1 barn owl/day = 1067.6/10 = 106.76 g

These results suggest that the barn owl consumes more than one prey per day. In our study the mean prey biomass consumed by each barn owl per day was 106.76 g.

Rodent management in Godavari delta districts of Andhra Pradesh

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Rodent pests are endemic in rice bowl areas in both east as well as West Godavari districts of Andhra Pradesh, with a perennial loss of about 10% in rice yields. These districts also face periodic rodent outbreaks preceding flash floods. The rodent infestation levels are often around 50 active burrows per hectare showing high density of the lesser bandicoot, *Bandicota bengalensis*. In view of this economic importance, the Government of Andhra Pradesh initiated rodent management measures on campaign basis in these districts during Rabi 2003-04 covering an area of 3.5 lakh hectares in East and West Godavari districts. The Directorate of Plant Protection Quarantine and Storages, Ministry of Agriculture (GOI) and Rodent Research Unit of AINP on Rodent Control (ICAR) at Acharya N.G. Ranga Agricultural University, Maruteru extended the requisite technical expertise. The farming community is aware of this problem and often resorts to their control at individual basis through bund trimming, burrow digging, smoking, trapping and poison baiting. However, the damage continues unabated contributing to significant losses mostly due to untimely control measures and absence of community-based actions

against these highly mobile pests.

Initially 477 officials of the Department of Agriculture, especially Multi Purpose Extension Officers (MPEO's) were given crash training on rodent management by the National Plant Protection Training Institute in collaboration with Rodent Control Project scientists in respective districts. This trained contingent have organized the rodent control operations covering 1.509 lakh ha in 54 mandals of East Godavari and 2 lakh ha in 28 delta mandals of West Godavari districts from 3rd to 6th February, 2004 in the crop fields and other lands of common property resourses. Gram Panchayats were involved in these operations by mobilizing farming community, contribution of bait material and manpower to treat the CPRs.

Table 1. Success of rodent control campaign in Godawari delta district of A. P.

S. No.	Name of District	Mandals Covered	Treated area (lakh ha.)	Rodent infestation levels				Control Success
				Before control		After Control		
				Burrows	Damage	Burrows	Damage	
1.	East Godavari	54	1.509	38	8.65	9	1.73	76.31 (80.0)*
2.	West Godavari	28	2.000	43	-	6	-	86.04

*On the basis of damage

The second-generation anticoagulant rodenticide, bromadiolone 'C' was used in this campaign. Since pre-baiting is not required while using this chemical, poison baits at 0.005% a.i. in broken rice were prepared at Gram Panchayats and the farming community applied the poison baits in 10 g paper packets inside the burrows. All precautions were taken to avoid any accidental toxicity during the campaign period. Evaluation of the control success was made by damage assessment and burrow count methods in randomly selected fields in each MPEO segment before and after the control operations. There was no report of any non-target animal mortality during or after this campaign. The particulars of the operations are given in the Table 1.

The cost of advertisement and publicity including miscellaneous expenses were up to Rs. 1.66 lakh for East Godavari and Rs. 3.91 lakh for west Godavari districts. The cost of the rodenticide was Rs. 18.11 and 24

lakhs for East and West Godavari districts, respectively. The Government of Andhra Pradesh spent a total amount of Rs. 47,69,066 towards the procurement of rodenticide and miscellaneous expenses, while the farmers contributed the bait material and labour. The estimated crop saved from the rodent damage is about 310 kg/ ha (with an average productivity of 4500 kg of rice) in the treated mandals with a monitory benefit of around Rs. 3,100 per ha. The contribution from the Department of Agriculture was Rs. 13.59 per ha with an equal cost met at farmers' level bringing the total cost of control operations to Rs. 27. Analysis of the entire control operation indicated that organizing the campaign at tillering stage of the crop, appropriate media and publicity at farmers' level and practical training at MPEOs' level immensely contributed to the success of the project. Commissioner and Director of Agriculture (A.P.) monitored the implementation of the scheme approved under the work plan of Macro Management in Agriculture. The farmers also expressed before the Commissioner of Agriculture during his visit that around 5 bags per hectare could be saved in this season from rodent ravages by this campaign.

A Report on Apex Level Training on Rodent Management at Maruteru

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Agril. Research Station (ANGRAU), Maruteru-534 122

Eighteenth Apex Level Training on Rodent Pest Management was organized from 25th to 28th February 2004 at Agricultural Research Station, Acharya N.G. Ranga Agril. University, Maruteru in collaboration with National Plant Protection Training Institute, Hyderabad.

Dr. S.M. Zaheeruddeen, Principal Scientist (Rice), ARS, Maruteru presided over the Inaugural Function on 25.2.2004. After a brief introductory address by Dr.(Mrs) K. Vasantha Bhanu, Scientist, Rodent Control Project, Maruteru, Dr. B.G. Naik, Director, NPPTI, Hyderabad and Chief Guest of the function delivered a Key note address on "Role of

Rodent Management in India as a component of IPM". The other dignitaries who addressed the inaugural session were Dr. R.S. Tripathi, Project Coordinator (Rodent Control), CAZRI, Jodhpur and Dr. A.M.K. Mohan Rao, Rodent Specialist, NPPTI, Hyderabad.

Fifteen trainees, two from Kerala, three from Karnataka and ten from Andhra Pradesh participated in the Training Programme. The resource scientists included : Dr. B.G. Naik and Dr. A.M.K. Mohan Rao (NPPTI, Hyderabad), Dr. R.S. Tripathi and Dr. Mohd. Idris (CAZRI, Jodhpur), Dr. P.C. Bansode and Dr. K. Satya Prakash (IGMRI, Hyderabad), Dr. S.M. Zaheeruddeen and Ms K. Vasantha Bhanu (ANGRAU, ARS, Maruteru) and Dr. V. Deva Prasad (ANGRAU, College of Agriculture, Baptla). In all, eleven training classes were conducted with emphasis on practical approaches in rodent pest management. On 25.2.2004, Dr. Mohan Rao briefed the trainees about the 'Role of Rodents in Public Health'. Dr. R.S. Tripathi delivered a lecture on 'Techniques of bait preparation and baiting'. Later Dr. M. Idris explained about 'Rodents of economic importance and their distributional patterns'. In the afternoon session Dr. P.C. Bansode, IGMRI, Hyderabad explained about the prevention of storage losses, particularly due to rodents.

On 26.2.2004, a field trip to Plantation Crops in Mungonda village of East Godavari district was arranged. Dr. Vasantha Bhanu trained the participants on identification and assessment of rodent damage in coconut, cocoa gardens and paddy fields. Fixing of physical barriers on coconut tree trunks, bromadiolone cake baiting in the crown regions were also demonstrated. Training on computation of economics of rodent management in coconut gardens was also provided to the trainees. Preparation of bromadiolone cake and its placement in cocoa was also demonstrated by Dr. Mohan Rao and Dr. Tripathi.

On 27.2.2004, Dr. V. Deva Prasad took a class on 'Rodent Pest Management in Rice'. Dr. Vasantha Bhanu briefed on identification of important rodent species and demonstrated the fumigation technique with Burrow Fumigator. Dr. R.S. Tripathi delivered a lecture on 'Recent advances in Rodent Pest Management'. Dr. Md. Idris emphasized about the Need of Peoples Participation in Rodent Pest Management. In afternoon

session Dr. V.J. Vara Prasad explained about 'Improvement of traditional storage structures'. Practical exercises on identifications of entry points for rodents and their signs of activity were also performed in nearby mills and warehouses.

On 28.2.2004, exercises on breeding biology and breeding profiles, community mapping and rodent seasonal calendar were taken up by Dr. Mohan Rao. At the end trainees evaluated the training programme and offered several suggestions.

In the closing session, the training report was presented by Dr. Vasantha Bhanu. The Commissioner and Director of Agriculture, Andhra Pradesh, Director, MARKFED, Hyderabad, Sub Collector, Rajahmundry and Dr. P. Raghava Reddy, Principal Scientist (Rice) and Head, ARS, Maruteru distributed certificates and training manuals to the trainees.

ALERT ON RODENT PROBLEM

Plant Protection Advisor (Government of India) has alerted the Directors of Agriculture and Horticulture of all states and Union Territories on possible rodent problem in coming season. He informed that the present erratic monsoon situation and likely crop withering due to prolonged dry spell in some parts of the country, especially in multiple cropping areas is conducive for better rodent survival and multiplication. Hence, rice crop in current kharif season is likely to be affected by pest rodents. PPA has requested the concerned states to caution the extension functionaries to popularize effective rodent management measures through IPM demonstration. Monitoring the rodent pest situations at periodic intervals can give forewarning on likely increase in rodent pest problem in order to initiate timely control measures. Therefore, priority may be given for the surveillance of the pest rodents by the field infestation reports as per following classification:

1. Heavy : 50 active burrows and above/ha
2. Moderate : 26-46 active burrows/ha
3. Low : less than 25 active burrows/ha

Considering the economic importance of rodent control, it would be appreciated if rodent control campaigns are organized. The States/Uts are also requested to convey their technical feedback to the Directorate of Plant Protection Quarantine and Storage (GOI), Faridabad.

NOTES AND NEWS

Ph.D. Awarded : Mr. Shiv Mangal Singh, Assistant Professor, C.S. Azad University of Agriculture and Technology, Kanpur was awarded Ph.D. degree on his thesis entitled "Bio-ecology and management of Indian metad, *Millardia meltada* Gray and Indian field mouse, *Mus booduga* Gray" submitted to C.S. Azad University of Agriculture and Technology, Kanpur under the supervision of Dr. A.S. Bhadauria.

UN Award : Rural Rodent Control Project implemented in Sichuan Province, Peoples Republic of China, was awarded Edouard Saouma Award of United Nations for the year 2002-03. The project was provided technical assistance by FAO through Dr AMK Mohan Rao, Rodent Specialist, National Plant Protection Training Institute, Hyderabad and International Consultant of FAO and Dr. Guo Cong, Sichuan University, Chengudu, China. The Project was implemented by Dr. Tu Jianhua, Director, Plant Protection Station, Chengudu, China. RNL family congratulates the awardees, especially Dr. Rao for this spectacular achievement.

International Conference : Dr. Neena Singla, Assistant Zoologist, AINP on Rodent Control, Department of Zoology and Fisheries, Punjab Agricultural University, Ludhiana attended 3rd International Wildlife Management Congress held at Christchurch, New Zealand, from December 1-5, 2003 and presented a paper entitled "Rodent Population Management in Mungbean Crop" by Neena Singla and V. R. Parshad.

RECENT LITERATURE

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

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