



WAR AGAINST RATS!

MANAGEMENT OF RODENT
PESTS IN SOUTHEAST ASIA

Newsletter 15 (April 2003)

The Australian Centre for International Agricultural Research (ACIAR) funds research projects on the Management of Rodent Pests in rice-based farming systems in Southeast Asia. The Community Ecology Group of CSIRO Sustainable Ecosystems coordinates these projects.

DEVELOPMENTS IN THE ACIAR PROJECT

Report on the

2nd International Conference on Rodent Biology and Management



The 2nd International Conference on Rodent Biology and Management (ICRBM) was held in Canberra, ACT, Australia from 10-14 February 2003. The conference, originally

planned for Bogor, Indonesia in October 2002, was postponed and re-located to Canberra following the Bali bombing. Despite the late change, 145 delegates from 34 countries were able to attend the conference. There were 2 parallel sessions over 4 days with 92 oral presentations and 52 poster presentations. The conference generated extensive and widespread media coverage.



The Commonwealth Minister for Science, The Hon. Peter McGauran, MP, officially opened the conference.

Above: Mr Thet Win; Dr Sudarmaji; Dr Fagi; Mr Peter Core; Dr Lyn Hinds; The Hon. Peter McGauran, MP; Dr Grant Singleton and His Excellency Mr Vu Chi Cong at the official opening of the conference.

The conference was co-hosted by CSIRO Sustainable Ecosystems and the Central Research Institute for Food Crops (CRIFC). The Australian Centre for Agricultural Research (ACIAR) was the main sponsor.

The conference consisted of **ten symposia**: Disease; Conservation; Behaviour; Management—field; Population ecology and modelling; Sociology and economics of

rodent management; Management—urban rodents and rodenticide resistance; Taxonomy and systematics; Rodent biology—contrasting perspectives, and Predator-prey interactions. Some highlights of the conference can be illustrated with the 8 plenary lectures:

Mike Begon: Disease: health effects on humans, population effects on rodents

Giovanni Amori: Rodents on islands: a conservation challenge

Charles Krebs: How does rodent behaviour impact on population dynamics?

Herwig Leirs: Management of rodents in crops: The Pied Piper and his Orchestra

Roger Pech, Stephen Davis and Grant Singleton: Outbreaks of rodents in agricultural systems: pest control problems or symptoms of dysfunctional ecosystems?

Murray Efford, B.M. Fitzgerald and P.R. Wilson: The role of aseasonal breeding in eruptions of feral house mice inhabiting New Zealand forests

David Cowan, **Roger Quay,** and Mark Lambert: Ecological perspectives on the management of commensal rodents

Ken Aplin, Terry Chesser and Jose ten Have: Evolutionary biology of the genus *Rattus*: profile of an archetypal rodent pest

A book entitled *Rats, Mice and People: Rodent Biology and Management*, edited by Singleton, Hinds, Krebs and Spratt, and published by the Australian Centre for International Agricultural Research (ACIAR), was officially launched at the conference by the Parliamentary Secretary to the Minister for Foreign Affairs, *The Hon. Christine Gallus, MP*.



Mr Peter Core, Dr Dave Spratt, Prof Charles Krebs, Dr Lyn Hinds, Dr Geoff Garrett, Dr Grant Singleton, The Hon Christine Gallus, MP and Dr Steve Morton at the official launch of the book.

The papers presented at the conference, and published in the book, demonstrated that the results from basic research in the

biological and social sciences now are exerting a major influence in our battle against the ravages and impacts of pest rodent species. Additionally, studies on the conservation biology of rodents have raised the spectre of the ecological services provided by this important group of animals. Ecological studies are essential to enable us to distinguish between the pest and non-pest status of different rodent species in different geographical areas and to target our control technologies appropriately. We have a responsibility to seek to balance the management of pest species with the conservation of beneficial species of rodents.

Topics of research that have been largely ignored by ecologists are parasites and diseases. There has been too little effort on the role of disease in limiting or regulating rodent populations, and on the impact of rodents on the health of humans and their livestock. We see this as an important area of growth over the next decade.

It is apparent that rodents shall continue to be of major importance as we seek to understand their biology and as we continue to develop new strategies for ecologically based management. In each of our respective research and/or extension fields, advances are being made in concepts and theory, in development and application of new technology and methodology, and in data capture and storage.

An important theme to emerge at this conference is that the lives of rats, mice and people are often interwoven, and scientists and extension staff alike must not ignore this relationship. We are encouraged by the number of papers that considered the influence of human actions on rodent population dynamics, the effect of rodents on human health, the importance of sociological and cultural factors on adoption of rodent management, and the effect of rodent management actions on the sustainability of agricultural production and, most importantly, on the environment.

Rodent systematics is one important topic that was missing from the 1st ICRBM held in Beijing in October 1998. Studies of the taxonomic status of rodents had a high profile at the 2nd ICRBM because of the recognition that we need to clearly define which species are causing problems in which regions, so that management can be geared

to their particular ecology and demographic machinery.

The Australian Agency for International Development (AusAID), through their International Seminar Support Scheme, and the Netherlands-based, European Union financed Technical Centre for Agricultural and Rural Cooperation (CTA), through their seminar support scheme, provided funds to support the attendance of scientists from Asia, Australia and Africa. The success of the conference heartened the Organising Committee. The Committee met in Canberra and plans are already underway for the 3rd ICRBM, which will be held sometime in the

second half of 2006. The venue is still to be decided but already we have offers in from both Lao PDR and Vietnam to host the conference. We extend our heartfelt thanks to the many people who worked so hard to ensure the 2nd ICRBM was a success. We look forward to renewing acquaintances and establishing new friendships in 2006!

Lyn Hinds, Grant Singleton, Alice Kenney and Charley Krebs (on behalf of the ICRBM organising committee)
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2nd ICRBM, 10-14 February 2003, Canberra, Australia.

(More conference photos have been posted on the following website:
http://www.cse.csiro.au/research/program4/community_ecology/rodents/icrbm2003.htm#photos.)

REPORTS FROM ABROAD

New ACIAR/CSIRO project in Myanmar

This is the first year of a new ACIAR funded project, "*Ecologically-based management of rodents in lowland rainfed cropping systems in Myanmar*", run by the Community Ecology Group, CSIRO Sustainable Ecosystems, Canberra. In March, Ken Aplin and Peter Brown travelled to Myanmar to conduct a training course on rodent biology and taxonomy. They also visited sites in Hmawbi and Yezin to speak with farmers and establish trapping sites and locations for demonstrations of the trap-barrier system (TBS).

Training Course

The course was run for local staff involved in the project. Thirty participants attended from across Myanmar, with representatives from most States and Divisions. The course was designed so that there was a mixture of theoretical and practical components. Each participant gave a presentation about the

history of rodent problems from their State or Division.

For the practical sessions, single-capture traps and a linear TBS were set in fields on the land managed by the Plant Protection Department (PPD) & Myanmar Agricultural Service (MAS). All captured rats were taken to the laboratory for processing. Participants learned how to handle and measure the rats and classify animals for different stages of breeding. Ken Aplin gave instruction on the process for



Participants of the training course.



Participants examining rodent specimens in the laboratory.

identifying species (features for taxonomy) and preparing specimens (skins) for collection. Video footage was taken of the course for the benefit of PPD/MAS and will be used as a resource in the future. Certificates for each course participant were presented at an official closing ceremony. The course was considered highly successful.

Taxonomy of rats

Very little was known about the rodent species that inhabit rice fields in Myanmar. Ken Aplin has changed all that. Rats were obtained by a combination of trapping, burrow excavation, and purchase from local rat hunters. Sixty-two specimens were collected at 3 sites. The results are listed in the table below. The collecting was far from exhaustive at any site, and additional taxa can be expected in central Myanmar (eg, *Rattus exulans*, *Rattus norvegicus*, *Mus musculus* subsp., *Mus booduga*).

| Species | Yangon | Hmawbi | Yezin |
|--|--------|--------|-------|
| <i>Rattus rattus</i> C (European) | + | | + |
| <i>Rattus rattus</i> B (East Asian) | | | + |
| <i>Bandicota indica</i> | | + | + |
| <i>Bandicota bengalensis</i> | + | + | + |
| <i>Bandicota savilei</i> | | | + |
| <i>Mus</i> sp. cf <i>M. cervicolor</i> | | + | |
| <i>Mus</i> sp. (rel. <i>caroli</i> ?) | | + | |
| <i>Suncus murinus</i> | + | | |

Signing of agreement between Myanmar and Australia (Signing Ceremony)

We were fortunate to be invited to the official signing ceremony between the Government of Myanmar and the Government of Australia on 31st March 2003. Present on the occasion were Minister for Agriculture and Irrigation Maj-Gen Nyunt Tin, Deputy Minister Brig-Gen Khin Maung and departmental officials, Australian Ambassador Mr Trevor Wilson and ourselves. The ambassador, Director-General U Tin Htut Oo of the Agriculture Planning Department, and Managing Director U Tun Than of Myanma Agriculture Service signed and exchanged the documents. An article appeared in *New Light of Myanmar*, Tuesday, 1 April 2003.

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The Signing Ceremony: Exchange of the official documents.



Dr Ken Aplin and Peter Brown with the Australian Ambassador, Mr Trevor Wilson at the Signing Ceremony.

RODENT RESEARCH AROUND THE WORLD...

INDONESIA

Jasmine tea in Cilamaya

What force drove me last year to convert from a pale German couch-potato into a curious continent-hopper? The war against rats!

My search for an exciting topic for my MSc thesis led me to CSIRO's Rodent Research Group in Canberra. My task was to gather data on the effect of Trap Barrier Systems (TBS) on the population structure of rice field rat populations in West Java for the ACIAR funded project 'Management of Rodent Pests in Southeast Asia'. Rice field rats (*Rattus argentiventer*) cause pre-harvest damage in Indonesian low land irrigated rice fields and are regularly controlled, usually by chemicals, hunting, fumigation of burrows, and trapping. I wanted to find out whether mainly residents living in the vicinity of a TBS were captured or whether mainly transient dispersers entered the traps of TBSs. Also, the constant removal of individuals was thought to create a change in the population structure of rice field rats living in the surroundings. What kind of change? This I also wanted to know. In June 2001, I packed my huge travel bag and got all vaccinations the worldwide pharmacy could offer.

Jens Jacob and Grant Singleton (CSIRO) supervised my work in Indonesia with input from Dale Nolte (National Wildlife Research Center, Olympia, WA, USA) who was spending a 3-month sabbatical at the Indonesian Institute for Rice Research (IIRR) where I would be working. Despite this familiar 'Western' company, the culture shock set in immediately. It was HOT. I was amazed about the variety of goods being offered along the roads: floating tyres, corncobs, water, peanuts, car oil, furniture and metal tops for mosques! I opened eyes and ears and got a quick course in the Indonesian conversational system: "Hello Mister!" Children stared at me as if I had come from another star. Supermarkets offered 'whiteners' to lighten the skin - twisted worlds.



Checking traps in the Trap Barrier System.

Everywhere around Sukamandi, tiny rice plants stretched towards the horizon. I was introduced to IIRR's facilities by Pak Sudarmaji, the leader of the IIRR Rodent Research Group. Nunung, companion and great helper, took me around on her little blue motorbike. My co-worker Didik, a student from Yogyakarta, and I selected a study area in Cilamaya, about 40 km northwest of Sukamandi. We chose three crop areas with TBS, and three controls without TBS. Sampling animals from TBSs was done daily and the surrounding areas and controls were sampled regularly by fumigation. Additionally, we used the bait marker Rhodamine B as part of a bait paste to mark resident rats. Didik and I spent the next weeks preparing bait, recruiting workers, analysing rat whiskers and eye-lenses, drawing maps of our plots, checking traps and dissecting animals. Didik used to march through the mud barefoot: "This is traditional medicine", he smiled.



Rattus argentiventer

After the data were analysed, we found that there were no differences in density between areas with and without TBSs. However, females in areas with TBSs were lighter, and a lower proportion of rats there were adult and reproductively active than in areas without TBSs. Our findings indicate that mainly immigrants were captured by TBSs, and that rapid re-colonisation may have led to a lower

quality of females. This clear effect on the reproductive potential of female rice field rats might slow population growth and reduce crop damage.

Every day after work, we went to a very nice *warung* (canteen), where a wonderful hot jasmine tea was awaiting us.

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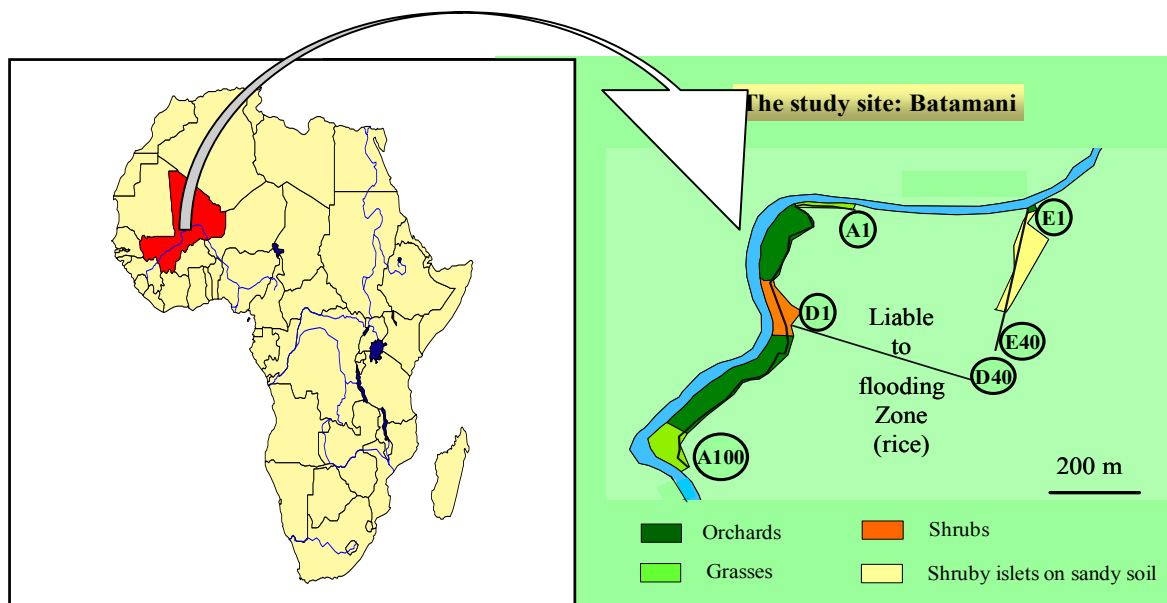
MALI

Studies into predation on *Mastomys huberti* in West Africa

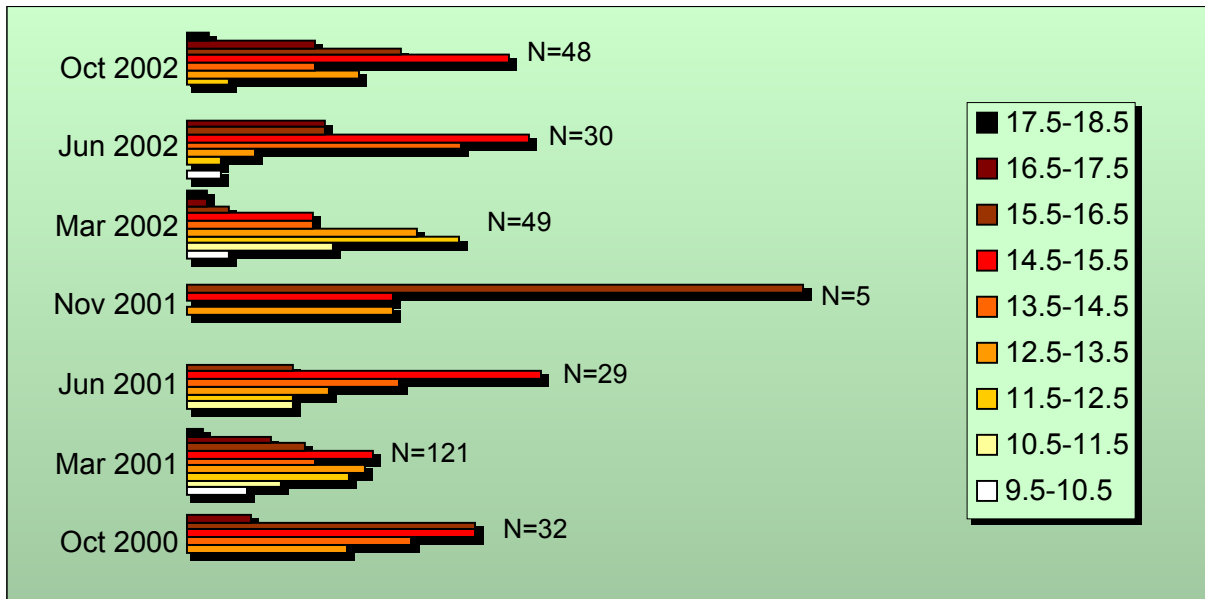
Mastomys huberti is one of the major pest species for agriculture in West Africa, where this species is mostly found in humid habitats, either natural or modified by Man (Duplantier & Granjon 1988). In Senegal, the recent development of irrigated agriculture along the Senegal River has caused a significant extension of the distribution of the species eastwards, with an increase in population numbers and apparent individual survival (Duplantier 1998). In Mali, the main agricultural region is the Inner Delta of the Niger River. This 30,000 sq. km zone is subjected to the annual flood of the Niger River, which makes it an especially suitable ground for rice growing. *Arvicanthus niloticus* and *M. huberti* are the main two rodent species represented, and both constitute a

threat to crops at various stages of their cycle.

In order to understand the functioning of *M. huberti* populations in this particular environment, we started in June 2000 a programme on population dynamics and genetics of this species in a representative site of the Delta. Regular trapping on lines encompassing the different habitats of the site have been performed, following a Capture-Mark-Release protocol. The results obtained concern demographic and spatial aspects of the annual cycle of *M. huberti* in relation with the flood-fall cycle of the River (Granjon *et al.* in prep.). Also, toe clips taken from individual animals will enable us to appraise the genetic structure of this population, through the use of specific micro-satellite markers.



Map of the study site (Batamani) in the Inner Delta of Niger River, Mali, showing the various habitats sampled by the trap lines (A, D and E). Barn owl's pellets were mainly collected under ronier palm trees of the larger orchard (near A100).



Distribution of relative frequencies of *M. huberti* mandible length (mm) in seasonal pellet samples in Batamani (Inner Delta of Niger River, Mali).

In the meantime, we also initiated a study on predation by the barn owl (*Tyto alba*), to try to evaluate the possible role of owls as a limiting factor of rodent populations.

Arvicanthis niloticus is mainly diurnal on the site so *M. huberti* was logically found to be the major prey species of the barn owl. This enabled us to study in some detail the composition of pellet samples collected during all trapping sessions. *Mastomys huberti* represented more than 70% of the total prey number, with the exception of November 2001 when bats dominated (mainly *Scotophilus leucogaster*). This period was the one of the lowest abundance of *M. huberti*.

To evaluate age structure of the samples of *M. huberti* preyed upon by the barn owl, we noted tooth wear and took measurements of skulls and mandibles retrieved from the pellets. Mandible length was found to be the best criterion for age estimation. Mandible length was well correlated with relative age (as deduced from tooth wear) and mandibles were sufficiently conserved to yield correct samples at all sessions (except November 2001, see above). The mandible length frequency distributions closely reflected age composition of the *M. huberti* population as observed by trapping: the March prey samples comprised a fair proportion of very small (i.e. very young) individuals, but also small numbers of very large ones. This accords with the population

consisting of mostly young individuals born after the end of the rainy season, when the flood recedes (November-January), with a few old animals still alive. In June, the prey samples contain a majority of animals of intermediate size, as in the trapped population where only individuals born in the previous reproductive period are present. This period was extended in 2002 following an exceptionally high flood, a fact that translated in the June 2002 pellet content where a few very small individuals were found. In October-November, mainly large to very large individuals were retrieved in pellets, echoing what was observed in the trappable population.

From this, it appears that the barn owl is an efficient predator of *M. huberti* in this context, as it has been shown to be for *Mastomys natalensis* in Tanzania (cf Vibe Petersen, War against Rats No. 11). It seems to hunt the different age classes as a function of their representation in the population. As such, it could certainly be a helpful agent for biological control of these pest species. However, the ease with which it can switch to another preferred prey in periods of low abundance of *M. huberti* is likely to aid in a rapid recovery of populations of this rodent species following a crash.

Duplantier, J.M. (1998) Les petits rongeurs indicateurs des modifications du climat, des milieux et des pratiques agricoles dans la vallée du fleuve Sénégal. Aménagements hydro-agricoles et santé (eds J.P. Hervé & J. Brengues), p. 53-65. Ed. ORSTOM, Paris.

Duplantier, J.M. & Granjon, L. (1988) Occupation et utilisation de l'espace par des populations du genre *Mastomys* au Sénégal:

étude à trois niveaux de perception. *Science et Techniques de l'animal de Laboratoire*, 13: 129-133.

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BELGIUM

Postcard from Antwerp

Dear WAR,

I am having a good time in Antwerp, Belgium. It is spring. The trees are putting out fresh leaves that look like they need a good iron, the birds announce themselves noisily in the morning and everyone is smiling. I have become involved in several rodent-related projects: sylvatic plague in great gerbil populations in Kazakhstan, hantaviruses in bank vole populations throughout Europe, rodents as an intermediate host of echinococcus, and a less specific project about rodent-borne zoonoses in African cities.

In the first week of May, I will visit Kazakhstan with a number of other scientists involved in the plague project. There will be me (the theoretical population biologist), Herwig Leirs (the real population biologist), Elisabeth (a microbiologist from Paris), and also Mike Begon (who looks a bit like Captain Picard from Star Trek and is just as nice). We are going to hire some sort of vehicle and drive out to a field site where Kazakh scientists are trapping great gerbils and taking blood samples. I will probably get to see a great gerbil and I will definitely get to see their burrow systems.

In July I am attending the African Small Mammal Symposium in Morogoro, Tanzania. It will be a good opportunity to

start thinking about rodent-borne zoonoses in African cities. It seems that there are quite a few such diseases that pose a threat to human health in this country. Apart from plague (yes, the same disease as in Kazakhstan) there is also leptospirosis and toxoplasmosis. Actually, I have no idea what these things are but I guess I will learn soon enough!

I have been very busy with the long term data set from Kazakhstan. There is a lot of information about abundance of gerbils and fleas, and about prevalence of plague. Already there are some nice patterns; the gerbil population is cyclic (with peaks in abundance every 9-10 years) and there appears to be a relationship between plague epizootics and gerbil abundance. I am enjoying trying to link theory and data. There is so much theory on host-pathogen dynamics - Anderson and May alone wrote tomes on the subject - but what do we expect to see for a given disease and a given host and what do we actually see?

I am looking forward to the time when we will have a nice "story" to tell about plague and great gerbils. Well, until then, goodbye. And don't forget to write!

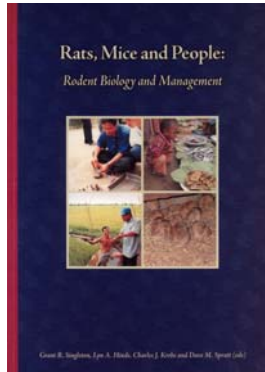
Best wishes,

Stephen Davis

STAFF CHANGES WITHIN THE RODENT RESEARCH GROUP OF CSIRO SUSTAINABLE ECOSYSTEMS

Dr Stephen Davis has accepted a position with **Dr Herwig Leirs** at the University of Antwerp in Belgium. **Dr. Tony Arthur** is joining the Community Ecology Group at CSIRO Sustainable Ecosystems. Tony will be working on epidemiology and transmission rates of Murine cytomegalovirus (MCMV) in house mice. He will start his new position in July.

RECENT PUBLICATIONS OF THE RODENT RESEARCH GROUP



Rats, Mice and People: Rodent Biology and Management, edited by Singleton, Hinds, Krebs and Spratt (published by ACIAR, 2003), is available in hard copy (AU\$50.00 including postage) or CD (AU\$20 including postage). The cost to developing countries will be discounted. Contact Rodent-inquiries@csiro.au for more information.

- Jacob, J. 2003. Response of small mammal populations to flooding. *Mammalian Biology* 68(2): 102-111.
- Jacob, J., Ylönen, H., Runcie, M.J., Jones, D.A. and Singleton, G.R. 2003. What affects bait uptake by house mice in Australian grain fields? *Journal of Wildlife Management* 67(2):341-351.
- Jacob, J. and Hempel, N. 2003. Effects of farming practices on spatial behaviour of common voles. *Journal of Ethology* 21: 45-50.
- Jacob, J. 2003. Short term effects of farming practices on populations of common voles. *Agriculture, Ecosystems and Environment* 95: 321-325.
- Singleton, G.R. 2003. Impacts of rodents on rice production in Asia. IRRI Discussion Paper Series No. 45, 30 pp, Los Banos, Philippines
- Brown, P.R., Singleton, G.R., Tann, C.R. and Mock, I. 2003. Increasing sowing depth to reduce mouse damage to winter crops. *Crop Protection* 22: 653-660.

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This newsletter presents the personal views of the individual authors and not necessarily those of ACIAR, CSIRO, or collaborators in ACIAR projects on management of rodent pests in rice-based farming systems in Southeast Asia.

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