

The Ecorat project: development of ecologically-based rodent management for the southern African region

Mulungu, L.S.¹, Belmain, S.R.², Dlamini, N.³, Eiseb, S.⁴, Kirsten, F.⁵, Mahlaba, T.³, Makundi, R.¹, Malebane, P.⁵, Von Maltitz, E.⁵, Massawe, A.¹, Monadjem, A.³, Taylor, P.^{6,7}, Tutjavi, V.⁴

¹Pest Management Centre, Sokoine University of Agriculture, P.O. Box 3110, Chuo Kikuu, Morogoro, Tanzania

²Natural Resources Institute, University of Greenwich, Central Avenue, Chatham Maritime, Kent ME4 4TB, United Kingdom, s.r.belmain@gre.ac.uk

³Department of Biological Sciences, University of Swaziland, Private Bag 4, Kwaluseni, Swaziland

⁴National Museum of Namibia, P O Box 1203, Windhoek, Namibia

⁵Agricultural Research Council – Plant Protection Research Institute, P/bag X134, Queenswood, Pretoria 0121, South Africa

⁶Durban Natural Science Museum, P. O. Box 4085, Durban, 4000, South Africa

⁷Dept of Ecol. and Resource Man., Univ. of Venda, P Bag X5050, Thohoyandou, 0950, South Africa

DOI: 10.5073/jka.2011.432.091

Abstract

The aim of this study was to carry out basic ecological research on rodent pests within subsistence-level agricultural communities in Africa. A range of techniques were used to collect baseline ecological knowledge on the temporal and spatial dynamics of rodent populations within rural farming communities in Tanzania, Swaziland and Namibia. These techniques included habitat surveys using removal trapping, capture-mark-recapture grids, and radio tracking of individually tagged animals. We also studied the local communities' knowledge, attitudes and practices with respect to rodents and their control, the current cost of rodent damage and the costs/benefits of rodent control. Based on these data, a case-control trial was implemented to evaluate an ecologically-based rodent management (EBRM) intervention using intensive trapping coordinated at the community level. Results showed that intensive trapping using community based rodent management was cost-beneficial for rural farming communities, and these EBRM strategies are ecologically sustainable. Our research has shown that efficacy is more than 75% when compared to what farmers normally do to reduce rat populations. Farmer training and community cooperation are essential, and expertise in social anthropology to develop appropriate knowledge dissemination platforms must be supported.

Keywords: disease, intensive trapping, population dynamics, rodent damage

Introduction

Rodents cause a myriad of problems for African households. Diseases incl. plague, Lassa fever, leptospirosis, typhus and food contamination caused by rats means that their disease burden alone makes rodents one of the most important problems facing African families (Meerburg et al., 2009). Nearly any crop can be damaged by rats. In any year a farmer may face crop losses of 5-20% but this can approach 100% during an outbreak, reaching epidemic proportions through aseasonal rainfall or other environmental changes (Normile, 2010, Singleton et al., 2010). Rat damage does not stop when crops are harvested, and many subsistence farmers continue to suffer serious losses when on farm storage is not rat proof. Despite serious damage, most African farmers do little to control rats. Repeated unsuccessful attempts to control rats have ingrained a sense of apathy and defeatism. In most cases, a farmer's measurement of success is having a few dead rodents as opposed to noticing that they have more food or that their families are in better health through fewer rodents. Research over the last two decades has refocused around an integrated approach to rodent management. EBRM strategies aim to understand the behaviors and breeding patterns of different rodent species and to use this knowledge to pinpoint problems and solutions. This rodent management paradigm has now taken centre stage in many parts of the world as a more sustainable solution (Brown et al., 2006; Jacob et al., 2010; Singleton et al., 2007; Sluydts et al., 2009; Stenseth et al., 2003).

Material and Methods

From January 2007 to December 2009, the ECORAT project carried out research on rodent ecology, rodent biology and rodent-human interactions. We studied the local agricultural communities' knowledge, attitudes and practices with respect to rodents and their control, the current cost of rodent

damage and the costs/benefits of rodent control. The multidisciplinary research consortium was drawn from institutions in Namibia, South Africa, Swaziland and Tanzania, with central technical input provided by the Natural Resources Institute of the University of Greenwich in the UK. The ECORAT project based its research within rural agriculture communities to study how rodents affect people's livelihoods. A range of techniques were used to collect baseline ecological knowledge on the dynamics of rodent populations in rural African farming communities. These techniques included habitat surveys by removal trapping, capture-mark-recapture, and radio tracking of individually tagged animals. An intervention program was carried out in 12 villages across the 3 countries; half of the villages followed their indigenous rodent management practice and half followed the ECORAT method. Indigenous rodent management is defined as what farmers in these villages normally do to manage rats: essentially occasionally using acute poisons. The ECORAT method of intensive daily kill trapping was organized at the community level, with traps rotating around the community to share the costs. This ensured that the rodent population was reduced at a large enough scale to limit the effects of immigration back into the intervention zone. The scientific team monitored and compared the indigenous and ECORAT method by assessing changes in the rodent population abundance as well as effects on rodent damage, particularly assessing differences in grain storage loss. The number of rats killed by intensive trapping in the six ECORAT villages was recorded, which acted as one form of monitoring as we compared this to monthly monitoring of the rat population in the six indigenous villages by three nights of kill trapping in a small number of homesteads. We also made further comparisons on what was going on with the rodent populations using tracking tiles.

Results and Discussion

Community based rodent management through intensive trapping was shown to be cost-beneficial for rural farming communities, and these EBRM strategies are ecologically sustainable. Our research has shown that efficacy is more than 75% when compared to what farmers normally do to reduce rat populations. Thus, considerable financial, health and food security benefits accrue to households that take part in ECORAT-style rodent management. However, challenges remain to promote widespread adoption. The problems that rats cause depend on local agro-ecological and socio-economic conditions, which must be understood in context. Farmer training and community cooperation are essential, and expertise in social anthropology to develop appropriate knowledge dissemination platforms must be supported (Palis et al., 2005). Research on rodent pests is relatively neglected due to a lack of awareness about the extent of the problem and 'new' EBRM solutions. We believe that strengthening the capacity of research and knowledge extension across African institutions to deliver EBRM would have major positive impacts on poverty and economic development across Africa.

References

- Brown PR, Tuan NP, Singleton GR, Ha PTT, Hoa PT, Hue DT, Tan TQ, Tuat NV, Jacob J, Muller WJ 2006 Ecologically-based management of rodents in the real world: application to a mixed agro-ecosystem in Vietnam. *Ecological Applications* 16: 2000-2010
- Jacob J, Sudarmaji, Singleton GR, Rahmini, Herawati NA, Brown PR 2010 Ecologically based management of rodents in lowland irrigated rice fields in Indonesia. *Wildlife Research* 37: 418-27
- Meerburg BG, Singleton GR, Kijlstra A 2009. Rodent-borne diseases and their risks for public health. *Critical Reviews in Microbiology* 35: 221-270
- Normile D 2010 Holding back a torrent of rats. *Science* 327: 806-807
- Palis FG, Morin S, Hossain M 2005 Social capital and geography of learning: Roles in accelerating the spread of integrated pest management. *Journal of Agricultural Education and Extension* 11: 27-37
- Singleton GR, Belmain SR, Brown PR, Aplin KP, Htwe KP 2010 Impacts of rodent outbreaks on food security in Asia. *Wildlife Research* 37: 355-359
- Singleton, GR, Brown, PR, Jacob, J, Aplin, KP, Sudarmaji 2007 Unwanted and unintended effects of culling: a case for ecologically-based rodent management. *Integrative Zoology* 2: 247-259
- Sluydts V, Davis S, Mercelis S, Leirs H 2009 Comparison of multimammate mouse (*Mastomys natalensis*) demography in monoculture and mosaic agricultural habitat: Implications for pest management. *Crop Protection* 28: 647-654
- Stenseth NC, Leirs H, Skonhofs A, Davis SA, Pech RP, Andreassen HP, Singleton GR, Lima M, Machangu RM, Makundi RH, Zhang Z, Brown PR, Shi D, Wan X 2003 Mice, rats, and people: the bio-economics of agricultural rodent pests. *Frontiers in Ecology and the Environment* 1: 367-375