UNIVERSITI PUTRA MALAYSIA

RANGING BEHAVIOR OF *Rattus novergicus* IN WET MARKET PASAR JALAN OTHMAN, PETALING JAYA

MUHAMMAD ZULHAFIZI WAHAB

FP 2016 41

RANGING BEHAVIOR OF *Rattus novergicus* IN WET MARKET PASAR JALAN OTHMAN, PETALING JAYA

MUHAMMMAD ZULHAFIZI BIN WAHAB

FACULTY OF AGRICULTURE

UNIVERSITI PUTRA MALAYSIA

SERDANG SELANGOR DARUL EHSAN

2015/2016

RANGING BEHAVIOR OF *Rattus novergicus* IN WET MARKET PASAR JALAN OTHMAN, PETALING JAYA

By

MUHAMMMAD ZULHAFIZI BIN WAHAB

168584

A project report submitted to Faculty of Agriculture, University Putra Malaysia, in fulfillment of the requirement of PAPER PROJECT (PRT4999) for the award of the degree of BACHELOR of AGRICULTURAL SCIENCE

Faculty of Agricultural

University Putra Malaysia

2015/2016

REPORT'S DECLARATION FORM

This project paper entitled "Ranging Behavior of Rattus Novergicus in Wet Market Pasar Jalan Othman, Petaling Jaya". Prepared by Muhammad Zulhafizi bin Wahab and submitted to the Faculty of Agriculture in partial fulfillment of the requirement of PRT4999 which is Final Year Project in purpose to achieve award of the degree of Bachelor of Agricultural Science is based on my own original works.

Student's name: Student's signature:

Muhammad Zulhafizi bin Wahab _____

Certified by:

_____

Prof. Madya. Dr Hafidzi Bin Mohd Noor

Department of Plant Protection,

Faculty of Agriculture,

University Putra Malaysia

Date: _____

ACKNOWLEDGEMENT

Praised be to Allah, The Only Almighty God that allowed me to complete my thesis by giving me the strength and consistency. In this short writing, I deeply want to extend my gratitude and appreciation to those that are directly or indirectly involved in this project. It took a lot of support, advice, contribution, great idea, and assistance from so many individual to complete this thesis.

Firstly, I want to thank my supervisor Prof. Madya. Dr Hafidzi Bin Mohd Noor , for his continuous supervision which thought me a lot of new experience and beneficial knowledge which in turn can be used as the new guidance for the next moment of my life. Without his support and motivation, it is impossible for me to get through this tough period. The next people that help me a lot to complete this task are my beloved parents. Thanks to Mr. Wahab bin Abdul Rahman and Mrs. Nazipah binti Safiai.

A part from that, I also want to share this gratitude to Miss Maisarah Burhanuddin and Miss Hafizah for their patience and assistance throughout this project period. They help me a lot in this project such as to set up the materials and apparatus needed.

Last but not least, I want to give my appreciation to my fellow friends that have been together in making this project come to success. In this opportunity I would to mention Nurul Awatif, Muhammad Riduwan, Muhammad Syazwan, Amirull Asyraf, Abdul Mustaqim and Mohamad Fauze Hazis.

TABLE OF CONTENTS

LIST OF TABLES

TABLES **PAGE**

LIST OF FIGURES

FIGURES **PAGE**

LIST OF APPENDICES

ABSTRACT

The rodents are the largest group of mammals that include rats, squirrels and porcupine. They are very successful and occupy every niche of the environment whether natural or modified. *Rattus* spp. are the source of a number of zoonotic pathogens responsible for human diseases and mortality. Recently cases of leptospirosis that are reported is increasing. *Rattus norvegicus* has over recent decades have dominated and become fully adapted to urban areas. The objective of this study is to understand the behavior of *R. norvegicus.* One aspect of behavioral study is the ranging behavior and pattern of habitat use. Radio telemetry was used in this study to map the home range and to investigate the activity pattern of *R. norvegicus*. 3 rats (1 mature male and 2 immature male) in and around the wet market of Pasar Besar Jalan Othman were captured using live trap cage and were anaesthetized for identification purpose. Radio transmitters of specific frequencies were attached to 2 rats (immature males). Radio tagged rats were followed from 2100 hrs to 0000 hrs or 4-5 hours over five days to mark the locations visited and extant of the area covered. Approximate locations of each rat were determined by triangulation method. The home range size and the core area were estimated using MCP (Minimum Convex polygon) and Kernel method. The home ranges analyses were calculated using the software Biotas of the Ecological Software Solutions Inc. The home range size of rat was influenced by the dissemination and the abundance of food or population density. The core area size was influenced by greater exploration get the desired food or favorite feeding spot. This study also showed that *R. novergicus* is more active early in the night and late night.

ABSTRAK

Roden merupakan kumpulan terbesar mamalia termasuk tikus, tupai dan landak. Mereka sangat berjaya dalam menduduki setiap pelusuk alam sama ada semula jadi atau diubah suai. Rattus spp. merupakan sumber beberapa patogen zoonotik yang meyebabkan penyakit dan kematian kepada manusia. Baru-baru ini kes leptospirosis yang dilaporkan semakin meningkat. Rattus norvegicus telah beberapa dekad mendominasi dan menyesuaikan diri sepenuhnya di kawasan bandar. Objektif kajian ini adalah untuk memahami tingkah laku R. norvegicus. Salah satu aspek kajian tingkah laku adalah banjaran kediaman dan corak penggunaan habitat. Radio telemetri telah digunakan dalam kajian ini untuk merangka banjaran kediaman dan mengenalpasti corak penggunaan habitat R. norvegicus. 3 tikus (1 jantan matang dan 2 jantan belum matang) di dalam dan sekitar Pasar Besar Jalan Othman telah ditangkap menggunakan perangkap sangkar hidup dan telah dipensangkan untuk tujuan identifikasi. Frekuensi radio pemancar yang spesifik ditag pada 2 ekor tikus (jantan yang tidak matang). Tikus yang diteg telah diikuti dari 2100 jam ke 0000 jam atau 4 - 5 jam selama lima hari untuk menandakan lokasi yang dilawati dan kawasan yang diliputi. Anggaran lokasi setiap ekor tikus ditentukan menggunakan kaedah triangulasi. Saiz banjaran kediaman dan kawasan teras telah ditentukanan menggunakan MCP (Minimum Convex poligon) dan kaedah Kernel. Analisis banjaran kediaman telah ditentukan menggunakan perisian Biotas daripada Ecological Software Solutions Inc. Saiz banjaran kediaman tikus dipengaruhi oleh penyebaran dan ketumpatan makanan atau populasi. Saiz kawasan teras dipengaruhi oleh penerokaan yang lebih besar untuk mendapatkan

makanan yang dikehendaki atau tempat makan kegemaran. Kajian ini juga menunjukkan bahawa R. novergicus lebih aktif pada awal malam dan lewat malam.

CHAPTER 1

INTRODUCTION

Rats do not only infest agricultural habitats but are common in urban areas. Rat damage to rice in Peninsular Malaysia was first reported in 1908 (Galagher, 1908). Chasen (1940) listed 26 species of rats in peninsular Malaysia of which 18 belonged to genus *Rattus*. Urban rat infestations and the associated public health risks have been on the rise with the increase in human population in urban areas. Infestations are heavy especially near food sources and potential rat harborages. They eat and contaminate food, damage structures and property, and transmit parasites and diseases to other animals and humans.

Rattus rattus and *R. norvegicus* are arguably the most successful invasive species on earth. Rats (*Rattus* spp.) are a source of a number of zoonotic pathogens responsible for human diseases and mortality. Potential carriers diseases that can affect humans such as Hanta virus (Haemorrhagic fever), Murine Typus (*Rickettsia typhus*), Leptospirosis, Bubonic plague and Plague (*Yersinia pestis*). To gain a better understanding of the foraging behavior of urban rat, the present study investigated of their activity pattern. Such a study may contribute to more effective control programs.

Several techniques have been used in studying the pattern of small mammals. Among these are unaided sighting (Shorten 1962), time-scheduled trapping

(Kamarudin 1982) and radio telemetry (Tokin 1983). While unaided sighting causes the least disturbance, it may not be suitable for less conspicuous animals like especially in a habitat characterized by dense foliage. Live- trapping techniques are suitable for studying population dynamics but will reveal little of the ranging behavior as animal are immobilized at point of capture. Radio telemetry was employed in this study as one clear advantage of this technique is that it allows continuous monitoring of animals with minimal disruption of their activities in their natural environment (Hafidzi, 1998).

The research objectives of this study are as follow:

1. To map the home range of *Rattus norvegicus* in urban area.
2. To investigate the pattern range of rat.
3. To investigate activity pattern of *Rattus norvegicus*.

REFERENCES

Atkinson IAE, Towns DR 2001. Advances in New Zealand mammalogy 1990-2000: Pacific rat. Journal of the Royal Society of New Zealand 31: 99-109.

Avalos, L., C. Callahan. 2001. "Classification and Characteristics of Mammals" (On-line). Accessed March 28, 2004 at http://www.humboldt.edu/~cmc43/mammalcharacters.htm

Barnett, S. 1963. The Rat. Chicago & London: University of Chicago Press.

Burton, M. and Burton, R. (2002) International Wildlife Encyclopedia. Third Edition. Marshall Cavendish, New York.

Chasen, F.N. 1940. On the form of rattus-rattus occurring on the mainland of the Malay Peninsular. *Bulletin Raffless Museum*. 8: 5-24

Calhoun, J. 1962. The Ecology and Sociology of the Norway Rat. Bethesda, MD: U.S. Department of Health, Education and Welfare.

Caccamise, D.F. & Hedin, R.S. 1985. An aerodynamic basis for selecting transmitter loads in birds. Wilson Bull. 97:306-3 l 8.

Clark, B. R., & Price, E. O. (1981). Sexual maturation and fecundity of wild and domestic Norway rats (Rattus norvegicus). Journal of Reproduction and Fertility, 63(1), 215 220

Cottam, C.; Stickel, W. H.; Stickel, L. F.; Coleman, R. H.; Mickey, A. B.; Schellbach, L.; Schorger, A. W.; Negus, N. C.; Polderboer, E. B. (1948). "Aquatic habits of the Norway rat". *Journal of Mammalogy* **29** (3): 299. JSTOR 1375396.

Cox MPG, Dickman CR, Cox WG 2000. Use of habitat by the black rat (Rattus rattus) at North Head, New South Wales: an observational and experimental study. Austral Ecology 25: 375-385.

Dale, E. (2008). *Pest Management Professional*. Retrieved 26 December, 2015, from http://www.mypmp.net/2008/05/01/myths-about-rodents/

Dowding JE, Murphy EC 1994. Ecology of ship rats (Rattus rattus) in a kauri (Agathis australis) forest in Northland, New Zealand. New Zealand Journal of Ecology 18: 19-28.

Driscoll, P.V. & Ueta, M. 2002. The migration and behaviour of Eastern Curlews Numenius madagascariensis. Ibis 144 (on-line): El 19-El 30

Firth RSC, Woinarski JCZ, Noske RA 2006. Home range and den characteristics of the brush-tailed rabbit-rat (Conilurus penicillatus) in the monsoonal tropics of the Northern Territory, Australia. Wildlife Research 33: 397-407.

Fuller, M.R., Millspaugh, J.J., Church, K.E. & Kenward, R.E. 2005. Wildlife radiotelem- etry. In Braun, C.E., ed. Techniques for wildlife investigations and management, pp. 377-417. The Wildlife Society, Bethesda, USA.

Furano, Anthony V., Karen Usdin. 1995. DNA "Fossils" and Phylogenetic Analysis using L1 (Line-1, long interspersed repeated) DNA to determine the evolutionary history of mammals. Journal of Biological Chemistry. 270 (43): 25301-25304.

Fragaszy, Dorothy Munkenbeck; Perry, Susan (2003). *The Biology of Traditions: Models and Evidence*. Cambridge University Press. p. 165.ISBN 0-521 81597-5.

Galager, W.J. 1908. Extemination of Rats. *Agriculture Bulletin Straits*. 7: 92-95.

GB Non-native Species Secretariat (NNSS): Factsheet - Brown rat (October, 2013) https://secure.fera.defra.gov.uk/nonnativespecies/factsheet/factsheet.cfm?speciesId=2979

Gandolfi, G.; Parisi, V. (1972). "Predazione su Unio Pictorum L. da parte del ratto, Rattus norvegicus (Berkenhout)". *Acta Naturalia* **8**: 1 27.

Garcia, J., F. R. Ervin, R. A. Koelling. 1966. Learning with prolonged delay of reinforcement. Psychon. Sci. 5(3): 121-122.

GB Non-native Species Secretariat (NNSS): Factsheet - Brown rat (October, 2013) https://secure.fera.defra.gov.uk/nonnativespecies/factsheet/factsheet.cfm?speciesId=2979

Hafidzi, M.N. (1991). Kajian Rodentia Perosak Koko dengan Penumpuan Kepada *Callosciurus notatus.* Pertanika. Pp. 120 122.

Hafidzi, M.N. (1998). Plantain Squirrel *Callosciurus notatus* in a Plantation Habitat. *Pertanika*, 21(1),

Hafidzi, M.N. (2012). The Ranging Behaviour of Tyto alba in Oil Palm under Baiting with Anticoagulant Rodenticides, Warfarin and Brodifacoum and a Biorodenticide Sarcocystis singaporensis (Zaman & Colley, 1975). Pertanika, 35 (2): 209 221.

Harris DB, Macdonald D 2007. Population ecology of the endemic rodent Nesoryzomys swarthy in the tropical desert of the Galápagos Islands. Journal of Mammalogy 88: 208-219.

Harrison,J.L. (1958). Range and movements of some Malayan rats. *J. Mammalogy* 39: 190 206.

Hooker S, Innes J 1995. Ranging behaviour of forest-dwelling ship rats, Rattus rattus, and effects of poisoning with brodifacoum. New Zealand Journal of Zoology 22: 291-304.

IUCN Red List (October, 2013) http://www.iucnredlist.org/

Jacob, A. A., Rudran, R., 2003. Radiotelemetria em estudos populacionais. In: Cullen, Jr., L.,Rudran, R., Valladares-Padua, C.B. (Eds.), Me´todos de estudos em Biologia da Conservac¸a o emanejo da vida silvestre. Editora da Universidade Federal do Parana, Curitiba, pp. 285 342.

John, D. (2012). *Animal Planet*. Retrieved 26 December, 2015, from http://www.animalplanet.com/tv-shows/infested/lists/4-seeing-a-rat-during-the-day-is-a-super-bad-sign/

Jason, M. (2005). Barn owl (Tyto alba). Departent of Wildlife Ecology and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences (IFAS), University of Florida.

Kamarudin, K.A. 1982. The ecology, pest status and control of the Malaysia wood rat *Rattus tiomanicus* (Miller) in the cocoa-coconut plantation. Ph.D Thesis, Michigan State University.

Kenward, R. 1987. WiMlife radio tagging. Academic Press, London.

Koeler, P, Antonio, F & Fernandez, S. (2008). A comparisonoftrapping-andradiotelemetry-basedestimatesofhome range oftheneotropicalopossum Philander frenatus. Mammalian Biology, 74(8), 1-8.

Krinke, Georg J. 2000. The laboratory rat. Tracie Bunton and Gillian R. Bullock, eds. Academic Press. 1st edition.

Leslie, P. H., Perry, J. S., Watson, J. S., & ELTON, C. (February 1946). The Determination of the Median Body-Weight at which Female Rats reach Maturity. In Proceedings of the Zoological Society of London (Vol. 115, No. 3-4, pp. 473 488). Blackwell Publishing Ltd.

Leung LK-P, Clark NM 2005. Bait avoidance and habitat use by the roof rat, Rattus rattus, in a piggery. International Biodeterioration & Biodegradation 55: 77-84.

Linzey, D. (2005). Rattus norvegicus. Retrieved 30 December, 2015, from http://www.discoverlife.org/nh/tx/Vertebrata/Mammalia/Muridae/Rattus/norvegicus/

MacDonald, D.W. and Fenn, M.G.P. 1994. The Natural History of Rodents: Preadaptions To Pestience. *In Rodent Pests and Their Control*. Edited by Buckle, A.P and Smith, R.H. CAB Intrnational. pp 1-22.

Meng, J. A. R. Wyss, M. R. Dawson, R. Zhai. 1994. Primitive fossil rodent from Inner Mongolia and its implications for mammalian phylogeny. Nature. 370. 134-136.

Merrill, S.B., Adams, L.G., Nelson, M.E. & Mech, L.D. 1998. Testing re- leasable GPS radiocollars on wolves and white-tailed deer. Wildlife Soc. Bull. 26: 830-835

Michigan DNR. (2015). Radio Telemetry. Retrieved 12 December, 2015, from http://www.michigan.gov/dnr/0,4570,7-153-10370_12143-70426--,00.html

Murakami, O., Priyono, J. and Triastiani, H. (1990). Population management of the ricefield rat in Indonesia. In Rodents and Rice, Report and Proc of an expert panel meeting on rice rodent control. Los Banos, Sept 10 14, 1990. Pp. 49 54.

"Norway Rat Behavior Repertoire". ratbehavior.org.

Norsham, M.R. (1987). Lakuan dan pergerakan burung Hantu *Tyto alba* dan tikus *Rattus* sp.. Latihan Ilmiah . Universiti Kebansaan Malaysia.

Nowak, R.M. (1991) Walker s Mammals of the World. The Johns Hopkins University Press, Baltimore and London.

Ostfeld, R.S. (1990). The ecological of territoriality in small mammals. *Trends in Elogical and Evolution*, 5: pp 411 415.

Parker, S. 1990. Grzimek's Encyclopedia of Mammals: Volume 3. New York: McGraw-Hill Publishing Company.

"Pest info- Rodents". BASF- The Chemical Company. Retrieved 14 January 2014.

Pryde M, Dilks P, Fraser I 2005. The home range of ship rats (Rattus rattus) in beech forest in the Eglinton Valley, Fiordland, New Zealand: a pilot study. New Zealand Journal of Zoology 32: 139-142.

Rey farve. (2015). Demonstration of Satellite/GPS Telemetry for Monitoring Fine-Scale Movements of Lesser Prairie-Chickens. Retrieved 12 December, 2015, from http://www.fs.fed.us/t-d/programs/im/satellite_gps_telemetry/wildlifetrackingtelementry.htm

Robert, C & Kirkwood, J. (2010). The Laboratory Rat. The UFAW Handbook on the Care and Management of Laboratory and Others Research Animal, 2(40), 312-313.

Russell JC, Towns DT, Anderson SH, Clout MN 2005. Intercepting the first rat ashore. Nature 437: 1107.

Samuel, M.D. & Fuller, M.R. 1996. Wildlife radiotelemetry. Pages 370- 418 in T.A. Bookhout, editor. Research and management echniques for wildlife and habitats. Fifth edition, revised. The Wildlife Society, Bethesda, MD.

Sanderson, R.S. (1990). The ecology of territoriality in small mammals. *Trends in Ecology and Evolution*, 5: pp 411 415.

Schein, Martin W.; Holmes Orgain (1 November 1953). "A Preliminary Analysis of Garbage as Food for the Norway Rat". Am. J. Trop. Med. Hyg. ***2*** *(6): 1117 30. PMID 13104820. Retrieved 4 April 2007.*

Shorten, M. 1962. Squirrels: Their Biology and Control. *Bulletin of the Ministry of Agriculture, Fisheries and Food*, 184. London.

Smith, C.E.G., Turner, L.H., Harrison J.L. and Brown, J.C. 1961. Animal leptospirosis inaMalaya. 3 Incidence in rats by sex, weight and age. *Bulletin Wildlife Organisation*. 24: 807-812.

Smithsoain migratory bird center. (2012). The Migratory Connectivity Project. Retrieved 12 December, 2015, from http://www.migratoryconnectivityproject.org/vhf-radios/

Steiniger, Fritz (1950). "Beitrage zur Sociologie und sonstigen Biologie der Wanderratte". Zeitschrift fur Tierpsychologie **7** (3): 356 79.doi:10.1111/j.1439-0310.1950.tb01630.

Sumangil, J.P. (1990). Control of Ricefield rats in the Philippines. In Rodents and Rice, Report and Proc of an expert panel meeting on rice rodent control. Los Banos, Sept 10 14, 1990. Pp 35 47.

TAITT,M.J. and KREBS, C.J. (1981). The effect of extra food on small rodent populations: II. Voles (Microtus townsendii). Journal of Animal Ecology, 50, 125-137.

Tan, D.S.K. 1973. Oocupational distribution of leptospiral antibodies in West Malaysia. Medical Journal of Malaysia. 27(4): 253-257.

Takekawa, J.Y., Warnock, N., Martinelli, G.M., Miles, A.K. & Tsao, D.C. 2002. Waterbird use of bayland wetlands in the San Francisco Bay Estu- ary: movements of Long-billed Dowitchers during winter. Waterbirds 25 (Special Publication 2): 93-105.

Takekawa, J.Y. & Orthmeyer, D.L. 2001. Application of radio telemetry in studies of cranes. Pages 85-98 in Z.H.R.L. Johnson, and R.C. Stendell, editor. Cranes in East Asia: proceedings of the symposium. U.S. Geologi- cal Survey, Midcontinent Ecological Service Center, Fort Collins, CO, Harbin, People's Republic of China. June 9-18, 1998.

Timm, R. (2005). *Norway Rats*. Retrieved 11 December, 2015, from http://icwdm.org/handbook/rodents/NorwayRats.asp

Tonkin, J.M. 1983. Activity patterns of the red squirrel (Sciurus vulgaris). *Mamm. Rev*. 13:99-111.

Tristiani H, Murakami O, Watanabe H 2003. Ranging and nesting behavior of the ricefield rat Rattus argentiventer (Rodentia: Muridae) in West Java, Indonesia. Journal of Mammalogy 84: 1228-1236

Usdin K, Chevret P, Catzeflis FM, Verona R, Furano AV. 1995. L1 (LINE-1) retrotransposable elements provide a "fossil" record of the phylogenetic history of murid rodents. Mol Biol Evol. 12(1):73-82.

Verneau O, Catzeflis F, Furano AV. 1998. Determining and dating recent rodent speciation events by using L1 (LINE-1) retrotransposons. Proc Natl Acad Sci U S A. 95(19):11284-9.

Warnock, N & Y takekawa, J. (2003). Use of radio telemetry in studies of shorebirds' past contributions and future directions. Wader Study Group Bullehn, 100(138),

Weimerskirch, H., Bonadonna, F., Bailleul, F., Mabille, G., Dell'Omo, G. & Lipp, H.-P. 2002. GPS tracking of foraging albatrosses. Science 295: 1259

Wikipedia. (2015). Telemetry. Retrieved 12 December, 2015, from: https://en.wikipedia.org/wiki/Telemetry#History

White, G.C.,Garrott,R.A.,1990. Analysis of Wildlife Radio-Tracking Data. Academic Press, London.

Wood, B.J. (1969). The extant of vertebrate attacks on the oil palm in Malaysia In Progress in oil palm (ed. P.D Turner) pp 162 184. Kuala Lumpur: Incorp. Soc. Planters.

Yigit, N, Colak , E & Sozen, M. (1998). The Taxonomy and Karyology of Rattus norvegicus (Berkenhout, 1769) and Rattus rattus (Linnaeus, 1758) (Rodentia: Muridae) in Turkey. *Tr J of Zoology*, 22(203), .