PATTERN OF HOST SPECIFICITY AND INTERACTIONS AMONG ECTO AND ENDOPARASITES OF RODENTS, SCANDENT AND PRIMATES IN MALAYSIA

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INTRODUCTION

- Host specificity is a key of life history trait that varies greatly among parasites (Poulin & Keeney, 2007)

- The understanding of the interactions involving parasites is key to understanding many biological assaults and emerging infectious diseases (Hatcher & Dunn, 2011).

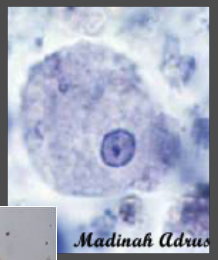
- The quantification of host-parasite relationships from field data was a fundamental step towards understanding host-parasite dynamics (Cumming, 2004).

- In Malaysia, the information of parasitic interaction and ecological networks structure of mutualistic between parasites of rodents, scandent and primates are generally lags.

OBJECTIVES

- To determine and assess the pattern of host specificity and interactions between parasites (ecto and endoparasites) and their hosts (rodent, scandent and primates) in Malaysia using networks analysis models.

parasites



Methods

Data collections

- using field surveys carried out in Malaysia (2008-2013) and from a literature database of all available interaction in entire Malaysia since 1928 (for primates data only)

Data Analysis

- Analyses were performed with *R v2.11* statistical programming language (R Development Core Team 2010). The package bipartite 1.10 (Dormann *et al*., 2008) and sna packages (Butts, 2008) were also used to calculate these indices.

RESULTS & DISCUSSION

(a) Pattern host specificity and interaction among ectoparasites of rodents and scandents in Malaysia

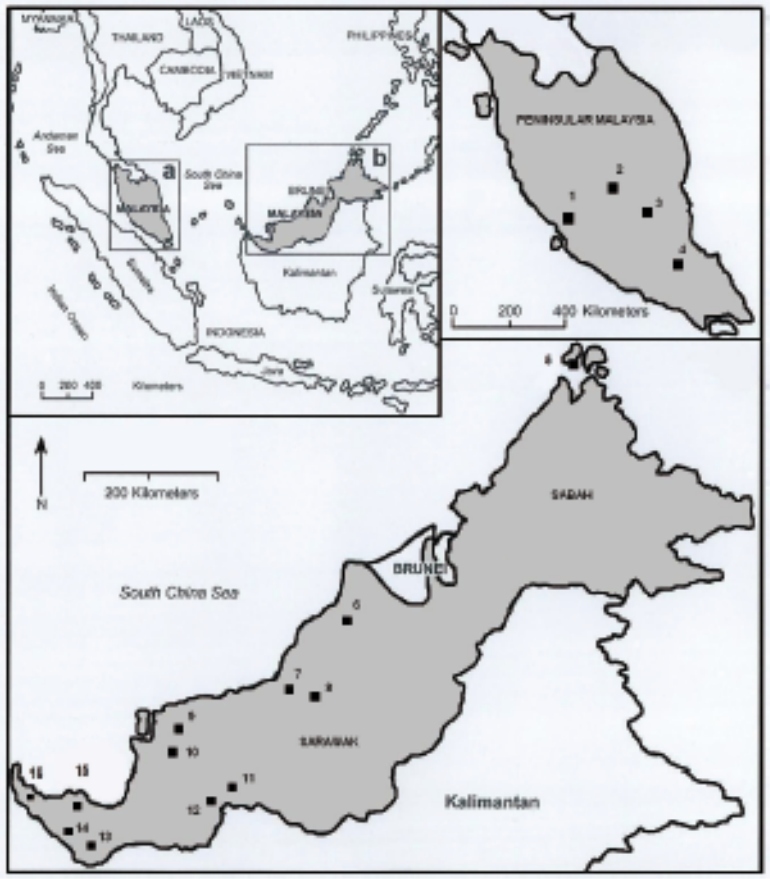


Figure 1. Peninsular and Malaysian Borneo of Sabah and Sarawak and the 16 localities where ectoparasites of rodents and scandents were sampled from 2008-2010. (**a**) 1: Sungai Dusun Wildlife Reserve, Selangor (SDWR); 2: Lata Bujang Krau Wildlife Reserve, Pahang (LBKWR); 3: Tasek Bera Ramsar Site, Pahang (TBRS); and 4: Endau Kluang Wildlife Reserve, Johore (EKWR). (**b**) 5: Balambangan Island, Sabah (BIS); 6: Niah National Park, Miri, Sarawak (NNP); 7: Rumah Temuai Nanga Merit, Kapit, Sarawak (RTNM); 8: Sungai Beletik Nanga Merit, Kapit, Sarawak (SBNM); 9: Bukit Aup Jubilee Park, Sibu, Sarawak (BAJP); 10: Human Settlement, Kanowit, Sarawak (HSK); 11: Sungai Bloh Lanjak Entimau Wildlife Sanctuary, Sarawak (SBLEWS); 12: Sungai Menyarin Lanjak Entimau Wildlife Sanctuary, Sarawak (SMLEWS); 13: Gunung Regu Padawan, Sarawak (GRP); 14: Kampung Giam Padawan, Sarawak (KGP); 15: Kubah National Park, Kuching, Sarawak (KNP); and 16: Bukit Pueh, Sematan, Sarawak (BPS).

Data collection details:

- Carried out from 16 localities in Malaysia from June 2008 until May 2010.
- Total host collected and examined for ectoparasites (n=142), 23 species
- Total ectoparasites 3,235 individuals collected (23 genera & 47 species) – belonging 3 main groups tick, mites & lice.

RESULTS & DISCUSSION Cont……

(i) Host (rodents & scandents)

- *S. muelleri* (Muller's rat) had the most diverse ectoparasite assemblage (Hs_w = 1.96) followed by *Maxomys ochraceiventer* (Hs_w = 1.77), suggesting that these species can accommodate variety of ectoparasites - often found near streams and also occur deep inside the forest, near the forest edge and human modified landscapes (Payne et al. 2005).

- rodents showed higher in ectoparasites loads compared to scandentia – due to behaviour of scandents (e.g: *Tupaia tana*) that irregular usage of the nest and their fur provides less optimal micro-habitat for ectoparasites (Muul & Lim, 1974; Shabrina & Rafaee, 1993)

(ii) Ectoparasites

- Mesostigmatid mites were the most diverse (Hs_w = 1.95, n = 2,165) and prevalent group (71.8%) - nest dwellers and are known to have a relatively high prevalence on rodents and scandents (Shabrina et al. 1989)

RESULTS & DISCUSSION Cont……

(iii) Interaction networks

- A total of 122 ecological relationships between ectoparasites and small mammals (rodents & scandents) (Figure 2).

- Overall complementary specialization index H2' of the database network was 0.67, suggesting moderate specialization.

- Lice assemblage showed the highest specialization (H2' = 1) while ticks appeared to be generalist (H2' = 0.35) (lack of specialization) compared to other groups - known to be highly specific to their mammalian host because It completes their whole life cycles within the host's pelage, thus, their host specificity is predicted to be higher (Marshall 1976).

- Tick appeared to be generalist for example *Ixodes granulatus (*ectoparasites species level) was found on 7 out of 16 rodent species (rats) and on *Tupaia tana* (Scandentia), exhibiting low host specificity (dp = 0.23)- known to be largely distributed on various host animals and has been identified as the common species of 3-host tick in Malaysia (Audy et al. 1960, Nadchatram 2008). .

RESULTS & DISCUSSION Cont……

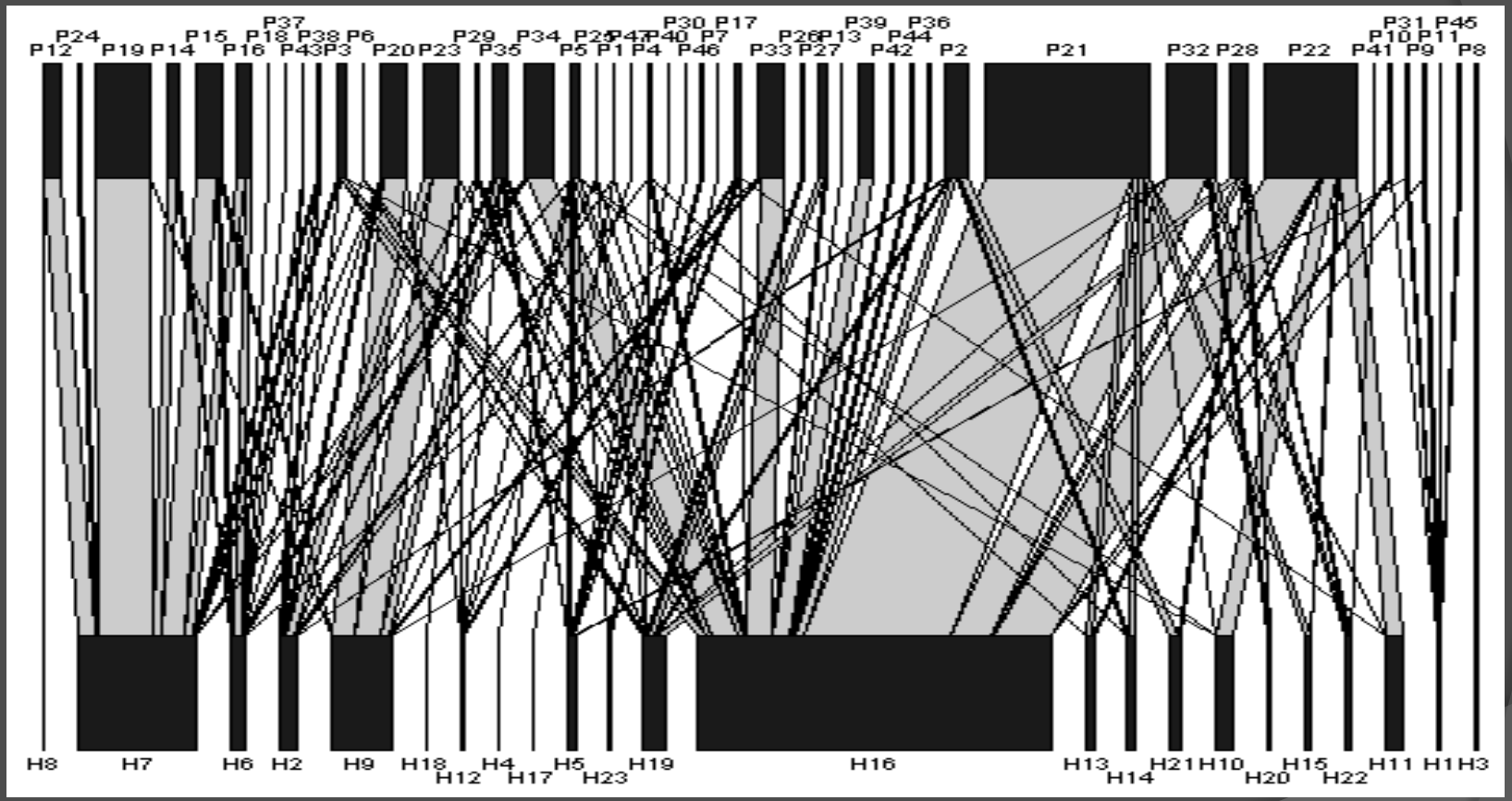


Figure 2: Quantitative ectoparasites small mammals (rodents and scandents) networks for tropical rainsforest in Malaysia

RESULTS & DISCUSSION Cont……

(a) Pattern host specificity and interaction among endoparasites of primates in Malaysia

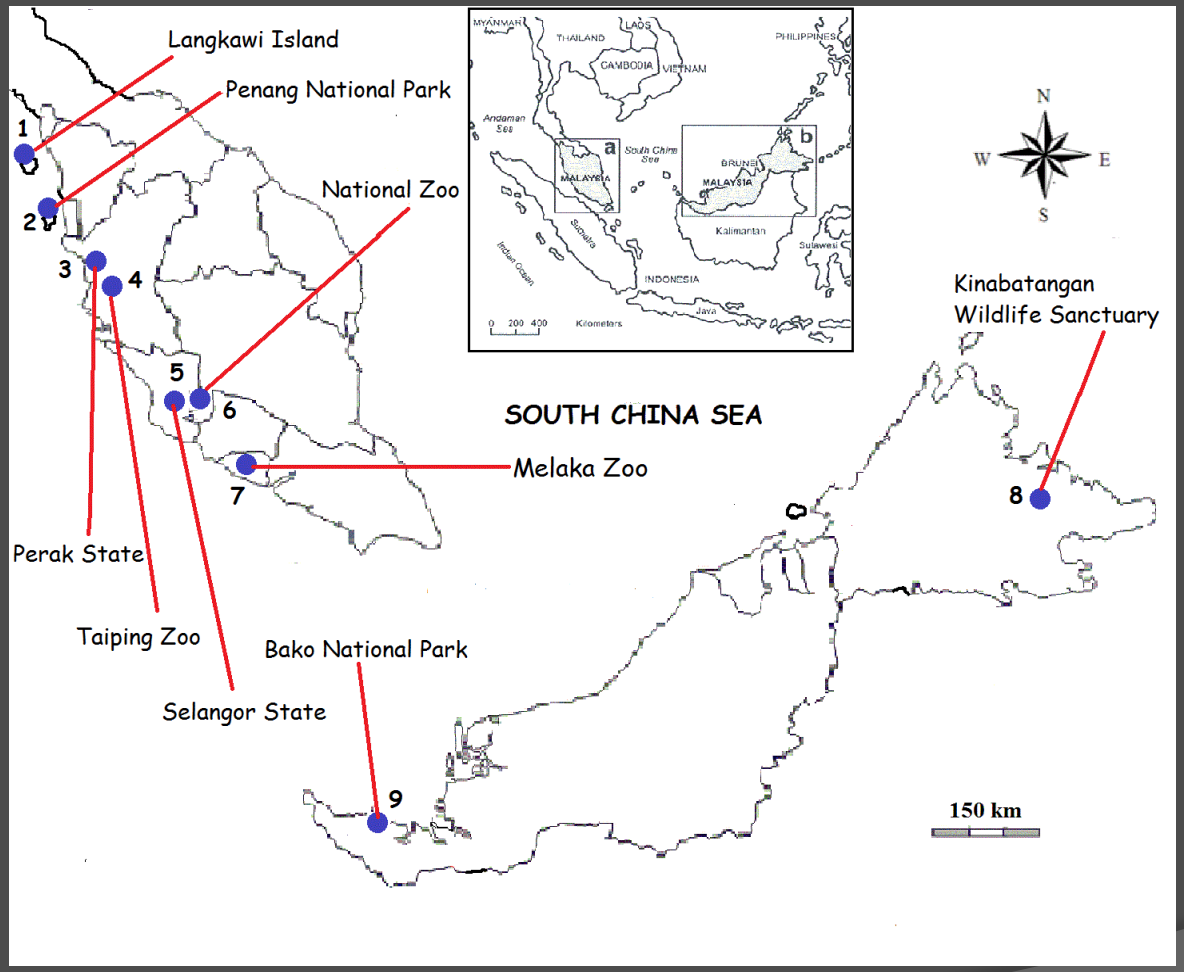


Figure 3: Map of two study areas with nine sampling sites in Malaysia

Data collection details:

- Carried out from compilation of previous and current studies (9 localities) (Fig 3)
- endoparasites- focus on gastrointestinal parasite
- Total host (primates) examined – 16 species of Malaysian primates (excluding human)
- Total endoparasites identified – 76 species with 5 distribution of GIT parasite (protozoan, nematodes, trematodes, cestodes & acanthocephalan)

RESULTS & DISCUSSION Cont……

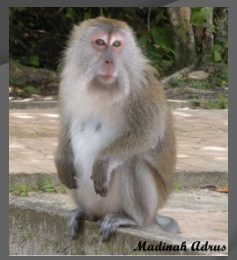
(i) Interaction Networks

- A total of 181 ecological relationships between 76 species of GIT parasites and 16 NHP species were verified from compiled data in Malaysia (Figure 4) – showed host specificity varied dramatically.

- The overall complementary specialization index H_2' of the database network was 0.15, suggesting low specialization among them.

- Specialized index for host (NHP) (*dh*) ranged between 0.02 to 1. The long-tailed macaque *M. fascicularis* (*dh* = 0.21), on which 37 different GIT parasite species were found, accounted for the most occurred interactions.

- Specialization indices among GIT parasite species (*dp*) ranged from 0 to 0.84. The GIT parasite *Ascaris* spp. (*dp* = 0.03) was found on 12 of the 16 Malaysian NHP species, suggesting that these GIT species can be infected with a variety species of NHP, thereby exhibiting low host specificity.



RESULTS & DISCUSSION Cont……

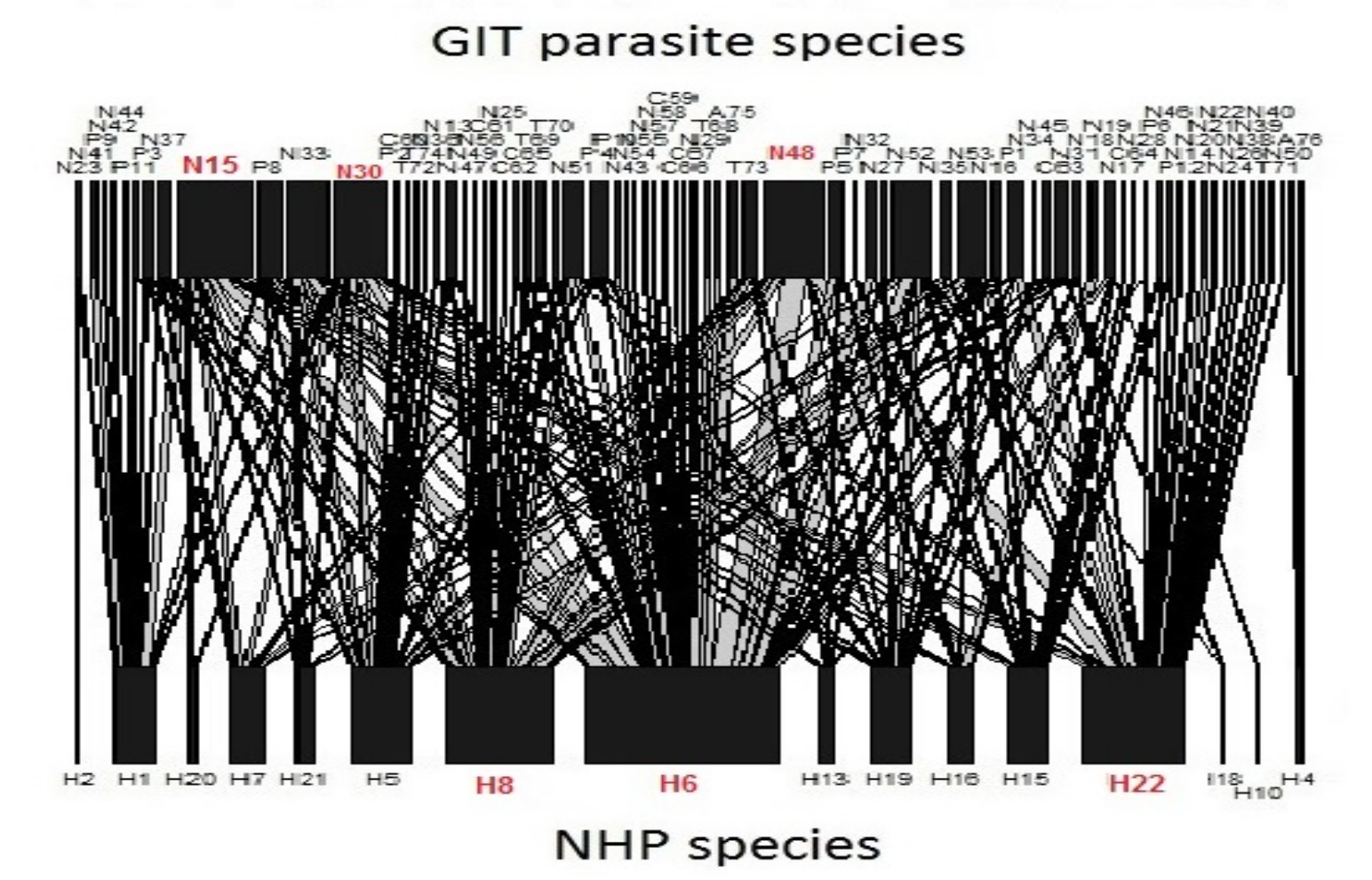


Figure 4: Quantitative NHP and GIT parasites interaction networks from compilation data from previous studies and current study in Malaysia with a total of 181 ecological interactions between 76 species of GIT parasites and 16 species of NHP. Frequencies of interactions are plotted as the linkage width. Code numbers of GIT parasites and NHP species (with N15 = *Ascaris* spp, N30 = Hookworm (*Ancylostoma* sp. or *Necator* sp.), N48 = *Strongyloides* sp. (GIT parasite species), H6 = *Macaca fascicularis*, H8 = *Nasalis larvatus*, H22 =*Pongo pygmaeus* (NHP species (host)).

CONCLUSION

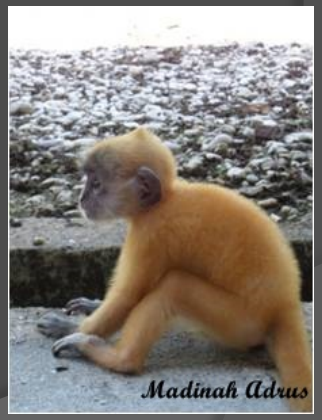
- Pattern of host specificity among ectoparasites of rodents and scandents showed moderate in specialization while among endoparasites of primates the interactions showed low in specialization.

- Information on host-parasite-pathogen interaction is important as it is related to management of zoonotic diseases.

- This study sheds some light on how these interactions are structured and it can potentially applied in predicting possible emergence of zoonotic diseases in Malaysia.

Way Forward.....

- Ecology and epidemiology study
- Transmission pathway of zoonotic diseases
- Developed the Field and Laboratory test of zoonotic diseases carried by vectors
- Regional Collaboration – save cost, sharing the knowledge, research facilities



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