



MUTUALISM IN *Ramanella nagoi* MANAMENDRA-ARACHCHI & PETHIYAGODA, 2001 (AMPHIBIA: MICROHYLIDAE) AND *Poecilotheria* SPECIES (ARACNIDA: THEREPSIDAE) FROM SRI LANKA

Submitted: 04 November 2008, Accepted: 05 January 2009

D. M. S. Suranjan Karunarathna¹ and A. A. Thasun Amarasinghe^{2,3}

¹ IUCN – Sri Lanka Country office, No: 53, Horton place, Colombo 07, Sri Lanka

² Taprobanica Nature Conservation Society, No: 146, Kendalanda, Homagama, Sri Lanka

³ Corresponding author: aathasun@gmail.com

Abstract

Ramanella nagoi is an endemic and vulnerable species of Family Microhylidae distributed in lowland wet zone rain forests and reproduce and live in and around tree hollows. This article presents some aspects of mutualism of *R. nagoi* with *Poecilotheria ornata* and *P. (cf.) subfusca* thereposid spiders in random field visits during the past seven years. This is the first observation of this symbiotic behaviour.

Key words: *Ramanella nagoi*, *Poecilotheria*, commensalism, inter-specific association, symbiotic relationship, Sri Lanka

Introduction

The frog Family Microhylidae in Sri Lanka represents four genera and ten species, while the genus *Ramanella* represents four species; *R. variegata* (Stoliczka, 1872), *R. obscura* (Günther, 1864), *R. palmata* Parker, 1943 and *R. nagoi* Manamendra-Arachchi & Pethiyagoda, 2001 respectively. *R. palmata*, *R. obscura* and *R. nagoi* are endemic, and *R. nagoi* is evidently restricted to tree hollows in the Kanneliya Forest Reserve in

Southern Sri Lanka (Manamendra-Arachchi & Pethiyagoda, 2001) and it is known from few other forests (e.g. Sinharaja, Kithulgala, Athwelthota, Gilimale, Kottawa-Kombala Forest near Hiyare, Nakiyadeniya, Dediyaagala, Hiniduma, Beraliya-Elpitiya and low altitudes in Sri Pada Nature Reserve). Here we describe observations of mutualism relationship between a microhylid frog, *Ramanella nagoi* and two species of tarantula

spiders; *Poecilotheria ornata* and *P. (cf.) subfusca*. Previous studies implicate few observations on commensalism interaction between microhylid frogs and spiders and the use of chemical cues used by the spider to recognize the frog (Crocroft & Hambler, 1989; Scakany, 2002). According to Siliwal & Ravichandran (2008) they observed the microhylid frog *Kaloula taprobanica* and the mygalomorph spider *Poecilotheria hanumavilasumica* sharing a tree hole in a tamarind tree in a private plantation on Rameshwaram Island. Miller (2003) examined another microhylid frog, *Hamptophryne boliviana* witnessed communing with the theraphosid spider *Xenesthis immanis*. Scakany (2002) observed the microhylid frog *Chiasmocleis ventrimaculata* and its burrow mate, a theraphosid spider. However, all the previous studies explain this relationship as a commensalism and here we show this relationship is more advanced and suggest it may be mutualism, instead.

Commensalism is a close association between two living organisms of different species, which is beneficial to one (the commensal) and does not affect the other (the host) (Taylor *et al.*, 1997). There are few examples of commensalism: some orchids or ferns on trees, egret and cow, shark and remora, Clown fish and sea anemone (Atwaroo-Ali, 2003; Siliwal & Ravichandran, 2008; Taylor *et al.*, 1997). Commensalism (com= together; mensa= table) means literally “eating at the same table” and is used to describe symbiotic relationships which do not fit conveniently in to the mutualism and parasitism categories (Taylor *et al.*, 1997). However, according to this observation there is a close association between two living organisms (*R. nagaoui* and *Poecilotheria* species) of different species, which is beneficial to both parties.

Observations

We recorded the mutualistic association between *R. nagaoui* and *Poecilotheria* species from Bambarabotuwa-Ratnapura (alt. 950 m; 6° 39' 53.35 N, 80° 35' 01.54 E), Kithulgala (alt. 120 m; 7° 00' 00.20 N, 80° 24' 59.86 E), Pompekale-Ratnapura (alt. 85 m; 6° 41' 04.70 N, 80° 24' 20.72 E), Athwelthota (alt. 210 m; 6° 32' 17.48 N, 80° 17' 03.49 E), Gilimale (alt. 390 m; 6° 45' 35.92 N, 80° 27' 13.51 E), Kottawa-Kombala near Hiyare (alt. 70 m; 6° 05' 44.48 N, 80° 18' 38.04 E), Kanneliya (alt. 200 m; 6° 13' 36.87 N, 80° 24' 05.17 E), Hiyare (alt. 120 m; 6° 03' 37.15 N, 80° 19' 27.93 E), Nakiyadeniya (alt. 180 m; 6° 11' 30.38 N, 80° 22' 39.89 E), Dediyaigala (alt. 240 m; 6° 11' 16.22 N, 80° 23' 59.68 E), Hiniduma (alt. 260 m; 6° 20' 08.13 N, 80° 18' 20.66 E), Koskulana-Panapola (alt.

450 m; 6° 25' 11.61 N, 80° 27' 05.43 E), Beraliya-Elpitiya (alt. 150 m; 6° 15' 48.58 N, 80° 12' 22.39 E) and low altitudes in Sri Pada Nature Reserve (alt. 400 m; 6° 46' 56.44 N, 80° 27' 26.11 E), all in Sri Lanka, in random field visits during the past seven years.

During these surveys we located 17 (17.35%) tree holes containing both of these species out of 98 tree holes where only either *Poecilotheria* species or *R. nagaoui* inhabited. During these surveys we located 66 tree holes with *R. nagaoui* (alone or with *Poecilotheria* species). Out of them 32 tree holes presence of eggs or tadpoles of *R. nagaoui*. Additionally, 34 tree holes were recorded with *Poecilotheria* species (alone or with *R. nagaoui*). Out of them, 17 tree holes had presence of eggs or juveniles of *Poecilotheria* species. During this survey we observed 12 tree holes with eggs and tadpoles or juveniles of both species in one tree hole, out of 17 tree holes where both species live together.

The natural predators on eggs of *Poecilotheria* species are mantids, ants and other spider species; for juveniles: mantids, *Hemidactylus depresses*, *Boiga* species and birds; for adults: *Boiga* species and birds. Natural predators of *R. nagaoui* eggs are *Hemidactylus depresses*, ants and *Boiga* species (De Silva (2006) observed *Cercaspis carinatus* occupied in the habitat of *R. nagaoui*); for juveniles: *Hemidactylus depresses* and for adults: birds. However we didn't observe any mantid, ant, other spider species or *Hemidactylus depresses* and *Boiga* juveniles in the tree holes where both *R. nagaoui* and *Poecilotheria* species inhabited during our random field visits. However, birds and adult *Boiga* species were observed while predating. We observed several times that the *Poecilotheria* species attacked on *H. depresses* while they were trying to eat *R. nagaoui* eggs (and De Silva (2006) also documented *H. depresses* feeds on *R. nagaoui* eggs. Furthermore, we also have seen many times *R. nagaoui* feeding on ants while they were attacking *Poecilotheria* species eggs. In addition, we have trace in many occasions the body parts of the preys fell in to the water while *Poecilotheria* species were feeding. Sometimes this nutrition may help for the survival of *R. nagaoui* tadpoles. Accordingly, we believe this relationship is advanced and it is not limited and depending strictly upon feeding. In conclusion, we suggest considering this relationship as mutualism, where both species gain benefits like food, and protection from predators, among others.

Acknowledgements

The authors wish to thank Enrique La Marca, Tzi Ming Leong and Mohamed M. Bahir for reviewing the manuscript. Then the first author would like to express his sincere thank to Mendis Wickramasinghe for providing valuable comments. Finally we would like to thank Dinesh Gabadage (TNCS) and Niranjan Karunarathna for their help.

Literature Cited

Atwaroo-Ali, L., 2003. *Macmillan CXC Science Series Biology*. Macmillan Publishers Limited, Malaysia: 100.

Crocroft, R. B. and K. Hambler, 1989. Observations of a commensal relationship of the microhylid frog *Chiasmocleis ventrimaculata* and the burrowing theraphosid spider *Xenesthis immanis* in southern Peru. *Biotropica*, 21 (1): 2-8.

De Silva, M. A., 2006. An experimental phytotelm conservation project for a Microhylid frog *Ramanella nagaoui*. *Loris*, 24 (3&4): 15-19.

Manamendra-Arachchi, K. and R. Pethiyagoda, 2001. *Ramanella nagaoui*, a new tree-hole frog (Microhylidae) from southern Sri Lanka. *Journal of South Asian Natural History*, 5 (2): 121-133.

Miller, G., 2003. Observations of commensalism between burrowing theraphosid spiders and the microhylid frog species, *Hamptophrynes boliviana*. *CNR Student Research Symposium*, College of Natural Resources, University of Wisconsin - Stevens Point: 24.

Scakany, J., 2002. *Study on the Chemical Communication between the Microhylid Frog, Chiasmocleis ventrimaculata, and a Theraphosid Spider involved in a Commensal Relationship*. Masters dissertation report submitted to State University of New York: 13.

Siliwal, M. and B. Ravichandran, 2008. Commensalism in Microhylid frogs and Mygalomorph spiders. *Zoos' Print Magazine*, 23 (8): 13.

Taylor, D. J., N. P. O. Green and G. W. Stout, 1997. *Biological Science*: Soper, R. (Ed.). Cambridge University Press, UK: 984.