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Bird-parasite Relations: A Hill Mynah Case Study

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Abstract: Ectoparasites were collected from 30 captive Hill Mynahs *Gracula religiosa intermedia* once a month for 12 months in 2002. The majority of Hill Mynahs were infected with *Myrsidea invadens* (64%) and *Brueelia chayanh* (34.5%). The other four ectoparasites found, accounting for 1.5% of all, included: *Androlaelaps casalis* (0.3%), *Ornithonyssus bursa* (0.4%), *Montesauria* sp. (0.7%) and *Analges* sp. (0.1%). On average, eleven *M. invadens* and six *B. chayanh* were found per bird. The study of habitat preferences and intensities of *M. invadens* and *B. chayanh* showed that the two species avoided interspecific competition. *M. invadens* preferred dorsal area whereas *B. chayanh* preferred ventral area of birds. The number of *M. invadens* was low in January, February and March meanwhile the number of *B. chyanh* was high but when the number of *M. invadens* was high in June, July and August, the number of *B. chayanh* was low. Although no bird died in this study, these ectoparasites caused weakness and weight loss by eating skin and annoying.

Key words: Ectoparasites, *Gracula religiosa*, Hill Mynah

INTRODUCTION

Hill Mynahs *Gracula religiosa* are very popular among cage pets because of their excellent vocal mimicry talent. The wild populations, so, are seriously being threatened[1]. The recent success in breeding Hill Mynahs in captivity will contribute to the supply of the cage bird trade at a certain degree[2]. Hill Mynahs are secondary cavity-nesting birds for which the cost of reused cavities is ectoparasites. Ectoparasites cause mortality and damage in several avian species such as weight loss[3,4], low productivity especially egg laying[5-7] and lower development rates[8]. In addition to the direct harm caused by loss of blood[9,10], destruction of tissue and allergic response[11-15], ectoparasites may transmit epizootic diseases to their hosts[16-18].

There has been no report about studying ectoparasites of Hill Mynahs in Thailand. Therefore, this study was undertaken to reveal bird-parasite relations including ectoparasite species that infected Hill Mynahs in Thailand, prevalence, intensity, habitat preference, relationship between parasites and Hill Mynah breeding season and any effect that ectoparasites might have on Hill Mynahs.

MATERIALS AND METHODS

The study was conducted in 30 Hill Mynahs (northern race, *Gracula religiosa intermedia*)[19] which were kept in five aviaries, 4x5x3 m^3 in dimension at the Zoological Research Station, Ramkhamhaeng University, Bangna Campus, Bangkok, Thailand from January to December 2002. Each bird was marked for identification. Before collecting the ectoparasites, birds weight was recorded every month. The ectoparasites were collected from each bird once a month, 30 days apart, by brushing three areas: dorsal, ventral and underwing with 90 different feather brushes for 30 birds in order to avoid mixing ectoparasites from each area. Each area was brushed along the feathers 30 times and the reversed the feathers 10 times. Every time, ectoparasites from each area of a bird were collected separately in 70% alcohol. Identification of ectoparasites was done under a microscope after the process of permanent slide was proceeded. The number of each ectoparasite species was also counted in each area every month. Prevalence, intensity, habitat preference and relationship between ectoparasites and bird conditions were analyzed.

The numbers of *M. invadens* and *B. chayanh* were compared by using Student's t-test and correlation

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coefficient. The significance of habitat preferences in these two species was tested by one-way ANOVA and correlation coefficient. The relationship between the intensity of ectoparasites and the body mass was statistically tested using correlation coefficient.

RESULTS

Six different ectoparasites were found in Hill Mynahs of Thailand in 2002 as shown in Table 1. *Myrsidea invadens* (Fig. 1) and *Brueelia chayanh* (Fig. 2) were the most (64%) and the second most (34.5%) found respectively in twelve months of the study. Both are in the class of insecta, meanwhile, the rest are in the class of arachnida, *Androlaelaps casalis* (0.3%), *Ornithonyssus bursa* (0.4%), *Montesauria* sp. (0.7%) and *Analges* sp. (0.1%). Most birds were infected with at least two species, *M. invadens* and *B. chayanh* (Table 2). *M. invadens* infected 83-100% whereas *B. chayanh* infected 37-97% of birds depended upon the time of year. *M. invadens* was found almost twice as many as *B. chayanh* ($t=2.8$, $p<0.01$). We found, on average, eleven *M. invadens* per bird and six *B. chayanh* per bird. The study of monthly intensity showed that the average of ectoparasites found varied from month to month, from seven to seventeen for *M. invadens* and from three to sixteen for *B. chayanh* (Table 3). The other four species which were also found in Hill Mynahs comprised only 1.5% of all ectoparasites. They were found in no more than five birds and only a very small number (1-4) of them were found in each bird.

Table 1: Ectoparasites found in captive Hill Mynahs *G. r. intermedia* 2002

Class	Order	Family	Species	Found (%)
Insecta	Phthiraptera	Menoponidae	*Myrsidea invadens*	64.0
Insecta	Phthiraptera	Philopteridae	*Brueelia chayanh*	34.5
Arachnida	Mesostigmata	Laelapidae	*Androlaelaps casalis*	0.3
Arachnida	Mesostigmata	Macronyssidae	*Ornithonyssus bursa*	0.4
Arachnida	Astigmata	Proctophyllodidae	*Montesauria* sp.	0.7
Arachnida	Astigmata	Analgidae	*Analges* sp.	0.1

Table 2: Monthly prevalences of ectoparasite infections in captive Hill Mynahs *G. r. intermedia* 2002

		Percentage infected with*					
Month	n	M	B	A	O	Mo	An
January	30	93	83	3	3	7	-
February	30	87	90	3	3	10	-
March	30	83	97	3	3	3	3
April	30	83	87	3	3	3	3
May	30	93	90	3	3	3	3
June	30	100	87	-	-	-	3
July	30	97	60	-	-	-	-
August	30	93	37	-	-	10	-
September	30	87	47	-	-	17	-
October	30	87	50	3	7	10	-
November	30	90	53	3	3	3	-
December	30	93	67	3	7	7	-

* M=*Myrsidea invadens*, B = *Brueelia chayanh*, A = *Androlaelaps casalis*, O = *Ornithonyssus bursa*, Mo = *Montesauria* sp. An = *Analges* sp.

Fig. 1: *Myrsidea invadens*

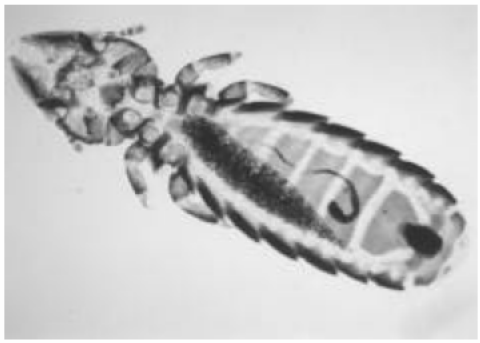

Fig. 2: *Brueelia chayanh*

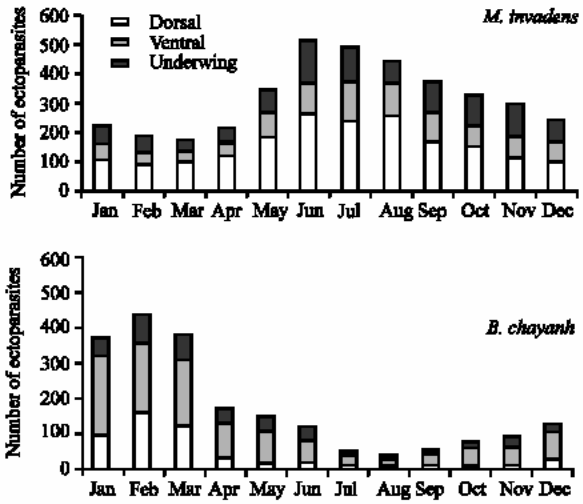

Fig. 3: The comparisons of habitat preferences and monthly number between *M. invadens* and *B. chayanh*

Therefore, the study of habitat preferences of ectoparasites was done only in *M. invadens* and *B. chayanh* (Fig. 3). The results showed that *M. invadens* preferred dorsal area of bird to ventral and underwing areas ($F=12.46$, $p<0.01$). As for *B. chayanh*, there was no statistically significant difference among the three

Table 3: Monthly intensities (Mean±SD) of ectoparasites in captive Hill Mynahs *G. r. intermedia* 2002 (the number in parentheses = the number of infected birds)

	Ectoparasites*					
Month	M	B	A	O	Mo	An
January	7.96±4.30 (28)	14.40±11.78 (25)	3.00±0.0 (1)	3.00±0.0 (1)	2.00±0.00 (2)	-
February	7.31±6.24 (26)	16.26±23.08 (27)	1.00±0.0 (1)	3.00±0.0 (1)	2.00±0.00 (3)	-
March	7.08±3.24 (25)	13.28±11.89 (29)	4.00±0.0 (1)	3.00±0.0 (1)	2.00±0.00 (1)	2.00±0.0 (1)
April	8.80±9.49 (25)	6.73±2.64 (26)	4.00±0.0 (1)	3.00±0.0 (1)	2.00±0.00 (1)	3.00±0.0 (1)
May	12.36±8.94 (28)	5.67±3.09 (27)	2.00±0.0 (1)	3.00±0.0 (1)	2.00±0.00 (1)	3.00±0.0 (1)
June	16.80±25.74 (30)	4.81±3.70 (26)	-	-	-	2.00±0.0 (1)
July	17.17±8.88 (29)	3.11±2.16 (18)	-	-	-	-
August	15.71±13.47 (28)	3.64±2.57 (11)	-	-	1.67±0.47 (3)	-
September	14.46±8.31 (26)	3.93±2.40 (14)	-	-	1.80±0.75 (5)	-
October	12.81±7.51 (26)	5.33±1.81 (15)	2.00±0.0 (1)	1.50±0.5 (2)	1.67±0.94 (3)	-
November	10.78±6.71 (27)	5.94±2.49 (16)	3.00±0.0 (1)	2.00±0.0 (1)	3.00±0.00 (1)	-
December	9.61±8.19 (28)	6.79±5.24 (20)	2.00±0.0 (1)	2.00±0.0 (2)	2.00±0.00 (2)	-

* M = *Myrsidea invadens*, B = *Brueelia chayanh*, A = *Androlaelaps casalis*, O = *Ornithonyssus bursa*, Mo = *Montesauria* sp. An = *Analges* sp.

habitats although a larger proportion of *B. chayanh* was found at ventral area. The correlation coefficient analysis of habitat preferences between these two species revealed that the number of *M. invadens* found in the particular area was negatively correlated with the number of *B. chayanh* found in the same area (at the dorsal area, r = -0.61, $p<0.05$; at the ventral area, r=-0.80, $p<0.01$ and at the underwing area, r=-0.59, $p<0.05$).

There were three temporal fluctuations in the association between the two ectoparasites during one year. The intensity of *M. invadens* was negatively correlated with the intensity of *B. chayanh* (r=-0.83, p=0.001). We found that the number of *M. invadens* was low in January, February and March meanwhile the number of *B. chayanh* was high and when the number of *M. invadens* increased in April, May and June, the number of *B. chayanh* decreased and when the number of *M. invadens* diminished again in July, August, September, October, November and December, the number of *B. chayanh* also heightened again (Fig. 3).

The relationship between the intensities of ectoparasites and the body mass showed that infection of *M. invadens* was negatively correlated with body mass (r = -0.79, $p<0.01$) whereas the infection of *B. chayanh* did not affect the body mass because of the low number infection.

DISCUSSION

Bird-parasite relations have been studied for years. Parasites are likely to play a role in practically every aspect of the evolutionary biology of birds. The parasites can affect bird fitness or population regulation. For example, birds weakened by disease may be more vulnerable to predation[20,21]. Moreover, the effect of ectoparasites on development rates and mortality levels of nestling birds is also reported[10]. Besides, relations between host behaviours, including territoriality, habitat selection, nest-site, mate choice, feeding, parental care and infection with parasitism were studied. It is attested that parasite can affect birds' reproductive success by causing nestling death and clutch abandonment and by changing parental behaviour during pair bonding, breeding and nesting[23-28].

The results from this study which was the first revelation of ectoparasites found in captive Hill Mynahs in Thailand, disclosed that the majority of Hill Mynahs were infected with *M. invadens* and *B. chayanh*. *M. invadens* and *B. chayanh* were the most and the second most numerous. Four other ectoparasites were only 1.5% of all ectoparasites in this study. These indicated that there were more than one host-specific ectoparasites found in this species. Previous studies showed different species and density of ectoparasites from our study. For example, nine *B. nebulose* were found per bird in starling in Family Surnidae[29]. *O. bursa* was found in majority in fowl *Numida meleahris galeata*[30], Turkey[12] and swift *Hirundo rustica*[31] while *A. casalis* was 33% of all ectoparasites found in 12 avian species[32]. It is possible that species of ectoparasites depend upon specific avian species, geography and environment.

The results of habitat preferences and monthly intensities revealed that *M. invadens* and *B. chayanh* avoided the interspecific competition in terms of habitats of feeding and reproduction. Moreover, the dorsal part of bird is suitable for *M. invadens* but *B. chayanh* prefers to inhabit in ventral area. This can be explained by size and morphological differences between these two species. Head size of *M. invadens* is 0.56x0.47 mm and abdomen is 0.61x1.14 mm. whereas head size of *B. chayanh* is 0.42x0.51 mm and abdomen is 0.48x1.31 mm. The shape of *M. invadens* is rather round but the shape of *B. chayanh* is elongated. Furthermore, *M. invadens* has longer and bigger legs than *B. chayanh*. These

morphological differences between the two species are eligible for *M. invadens* to select dorsal part for habitat due to gravity. In the dorsal area *M. invadens* can cling firmly with its round shape and strong legs. On the contrary, *B. chayanh* has thin elongated body which is suitable to be at the ventral area especially when birds fly and expose to the wind.

The relationship between the intensity of each ectoparasite and breeding season showed that the intensity of *M. invadens* was high at the end of breeding season (breeding season is January to July[1]) and during non-breeding season (August to December[1]) and low at the beginning of breeding season. But *B. chayanh* was numerous at the beginning of breeding season and gradually decreased towards the end of breeding season and the beginning of non-breeding season. Finding of this study may suggest that the intensity of *M. invadens* or *B. chayanh* depends upon the physiological condition of bird especially sex hormones. There was a hypothesis proposed that dominance status in mammal was inversely correlated with parasite load. Females consequently mate with dominant males and produce young which carry pathogen resistant genes[33]. Following this good genes hypothesis a study on birds[34] proposed that male ornaments signaled the bearer's health and freedom from parasites and that resistant males within a species had brighter plumage and more vigorous displays than susceptible males. As a consequence, bright plumage in male birds might have evolved from female preference for males with a healthy appearance. However, the male secondary sexual characters such as colourful plumage or elaborate courtship displays and dominance status are controlled by sex hormones[35]. The relationship between parasites and hormones in Hill Mynahs should be further studied.

Birds are host to many groups of mites. In addition to feathers, mites infest the skin, subcutaneous tissue, nasal cavities, trachea, lungs and air sacs[4]. Although no bird was dead in this study, ectoparasites caused weakness and weight loss by eating skin and being annoying resulting in birds' restlessness[8]. The intensities of *A. casalis*, *O. bursa*, *Montesauria* sp. and *Analges* sp. were not correlated with body mass of birds. Present finding was different from the study in New Zealand where *O. bursa* caused weight loss in starling[7,10]. The discrepancy may be attributed to the very small proportion (0.4% of all ectoparasites) of *O. bursa* in this study. Although it has generally been accepted that a successful parasite maintains a harmless level of infection with its host, the effect of ectoparasites on body mass of Hill Mynahs in this study suggests that if present in high number, these parasites may consequently cause low productivity or mortality. The relative importance of parasites in increasing mortality versus decreasing reproduction can have a strong effect on population dynamics.

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