

Evaluating conservation status of moths(Insecta: Lepidoptera)
at Kadoorie Farm & Botanic Garden, Hong Kong,
for consideration in site management

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Introduction

Kadoorie Farm & Botanic Garden (KFBG), located in the central New Territories of Hong Kong, comprises a mosaic of agricultural & horticultural land and secondary forest in 148 ha ranging from 130 m to 610 m elevation.

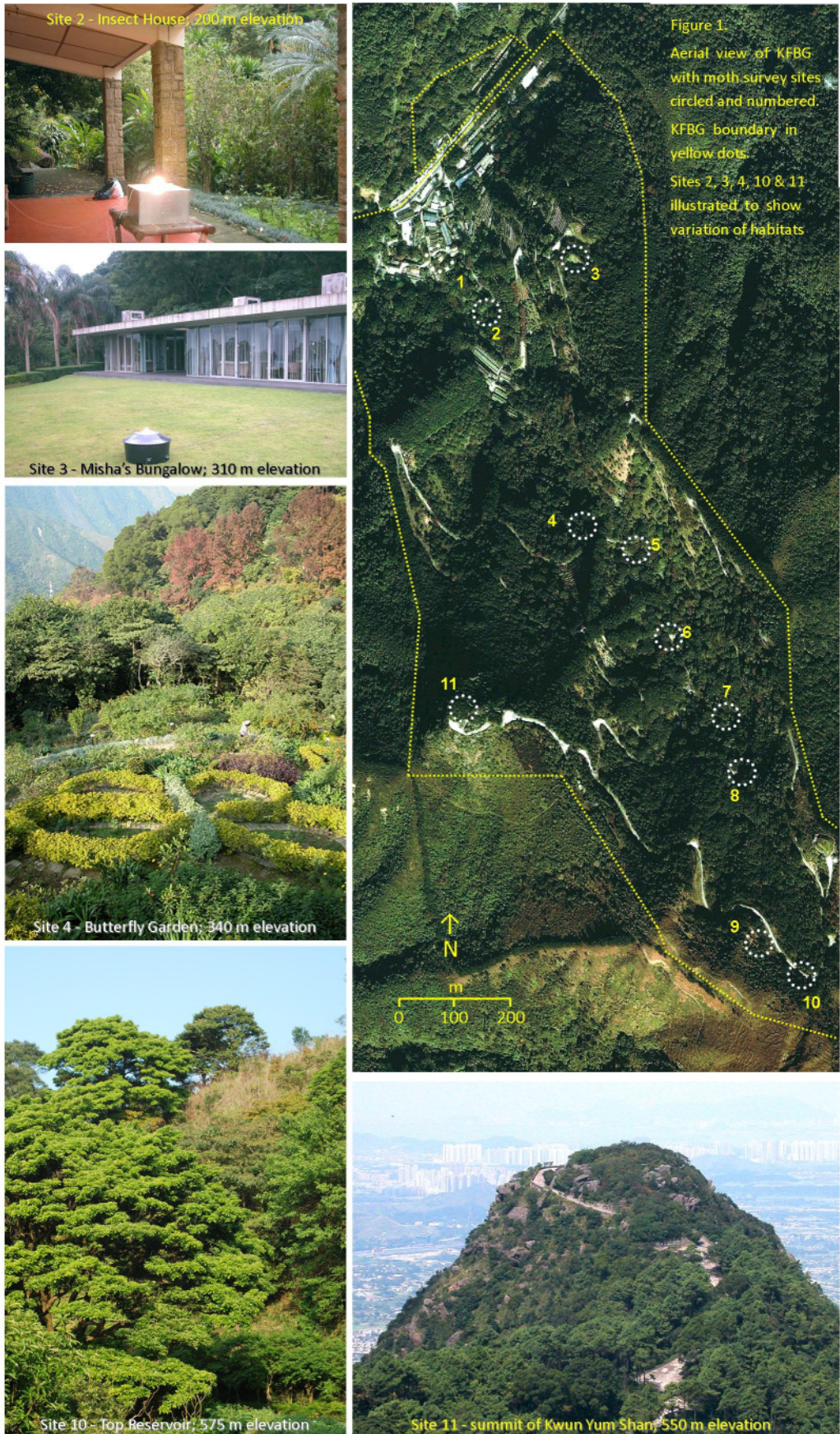
Moth recording has taken place routinely since 1999 The aim was to firstly obtain a relatively complete list for each chosen sampling site and then to monitor for any assemblage change. Sites that receive relatively intensive management compared with non-intervention forest areas received priority for sampling.

The data generated from these surveys is now used as part of the process of deciding upon land management uses at KFBG.

Recording:

Moth samples were obtained by light trapping with 125W mercury vapour light bulbs and Robinson and Skinner traps (Fry & Waring 1996), monthly, normally overnight, *weather permitting*, in one, two or sometimes three sites from a total of 11 sites (Table 1 & Figure 1) within KFBG. Since 2001 all sampling included abundance data. More effort to measure actual species richness took place at Misha’s Bungalow and the Butterfly Garden.

Identification of species has been from comparison with literature (primarily Fauna Sinica Insecta, Haruta (ed.; 1992-1998), Holloway (1982-present) and Wang (1993-1998), plus a multitude of monographs and journal papers usually dealing with a few species, genera or, in a few cases, families), museum collections and specialist moth taxonomists/curators (see acknowledgements). A voucher collection of some 7,000 dried adult moth specimens is maintained at KFBG and added to when necessary.



Moth Species Conservation Evaluation

All species recorded at KFBG were assessed against IUCN Red List criteria (IUCN 2001). Each species global distribution was determined from published sources, museum data (*loc. cit.*) and internet websites [LepIndex; Global Taxonomic Database of Gracillariidae; Forum Herbulot (Geometridae); Pyraloidea; Tortricid.net; Moths of Japan].

Each species population data from Hong Kong was obtained from Kendrick (2002), and subsequent field survey data, and southern China (Wang M. & Li H.H., pers. comms.).

Comparison of sites at KFBG

Using abundance data only, sites within KFBG were compared for the similarity of their assemblages, alpha diversity and evenness (following Gray 2000), calculated with Primer v.6 (Clarke & Gorley 2006) and number and composition of species meeting IUCN Red List criteria.

Table 1: description and current management of sites recorded with light traps at KFBG

Site	Name	Elevation / m	Aspect	Slope / °	Habitat(s)	Current management
1	Kwun Yum Garden	185	NNE	10	Lawn, plantation, agriculture & 2° forest	Agricultural + horticultural
2	Insect House	200	N	15	2° forest	Horticultural + native trees
3	Misha’s Bungalow	305	NW	15	Lawn + 2° forest	Horticultural, native + exotic trees
4	Butterfly Garden	340	N	30	2° forest “glade”	Horticultural + native trees
5	Fern Walk	330	NE	25	Closed canopy 2° forest	Plant conservation + native trees
6	Medicinal Herb Garden	375	NE	30	Open 2° forest	Horticultural + native trees
7	Magnolia Falls Path	435	W	20	Closed canopy 2° forest	Conservation area
8	Magnolia Reservoir	455	NW	15	2° forest “glade”	Conservation area
9	Grassland Path	575	N	25	Grassland & tall shrubs	Conservation area
10	Top Reservoir	570	NE	30	Open 2° forest	Horticultural + native trees
11	Kwun Yum Shan (Summit)	550	W	5	tall shrubs	Plant conservation, Horticultural + native trees

Results

Table 2: incidence records of moth species found at KFBG meeting IUCN Red List criteria CR, EN, VU & NT (# = endemic to Hong Kong)

Provisional IUCN Red List Status	Site number											KFBG
Species name [Figure no.]	1	2	3	4	5	6	7	8	9	11		
Number of incidence records of each species												
CR <i>Athetis bispurca</i> [2a] #			1	2								3
<i>Egira ambigua</i> #			2		1	1						4
<i>Sugitania</i> sp. nr. <i>lepida</i> #				1								1
EN <i>Acidon paradoxa</i> [2b]	1	3	17					1	1			23
<i>Belciana scorpio</i> #			1	4	2					1		8
<i>Chasmodon sinuata</i> #									1			1
<i>Eupithecia sekkongensis</i> #			1	2								3
<i>Feliniopsis margarita</i> #				3			1					4
<i>Luceria striata</i>			1	4			1	1		1		8
<i>Neospastis sinensis</i>			1	4	1					1		7
VU <i>Acidon evae</i>			1	4				1				6
<i>Bertula retracta</i>					1							1
<i>Hypena</i> sp. nr. <i>umbripennis</i>									1			1
<i>Hypolamprus</i> sp. nr. <i>emblicalis</i>			1	1						1		3
<i>Hyposada kadoorieensis</i> #				1	1					1		3
<i>Micromelalopha albifrons</i>			2	1								3
<i>Oglasa stygiana</i> #			2	7				1		4		14
NT <i>Athetis hongkongensis</i> #	1	2	6	18	2	1				9		39
<i>Calletaera digrammata</i>			6	25	3	1	1	1	1	9		48
<i>Cerura priapus</i> [2d]			2	1	1					2		6
<i>Cerynea discontenta</i> [2c] #		2	5	9			1	1				18
<i>Feliniopsis hyperythra</i>				1								1
<i>Gibbovalva singularis</i>		1							1	1		3
<i>Lysimella lucida</i>	1		3	14					1	3		22
<i>Maxates brevicaudata</i>			2	6				1				9
<i>Microcalicha reesi</i> #			1	4								5
<i>Miresa</i> sp. nr. <i>argentifera</i> [2e]				8	1					2		12
<i>Palpita minuscula</i> #		1		1				1	1	1		4
<i>Pangrapta bicornuta</i> #		1	3	21	6	2	1	1		3		38
<i>Pangrapta roseinotata</i> [2f] #			4	18	4	1				3		30
<i>Sigilliclystis kendricki</i> #			8	8	1	1				7		25
<i>Ugla purpurea</i> #	1	5	22	35	5	2	1	4		4		79

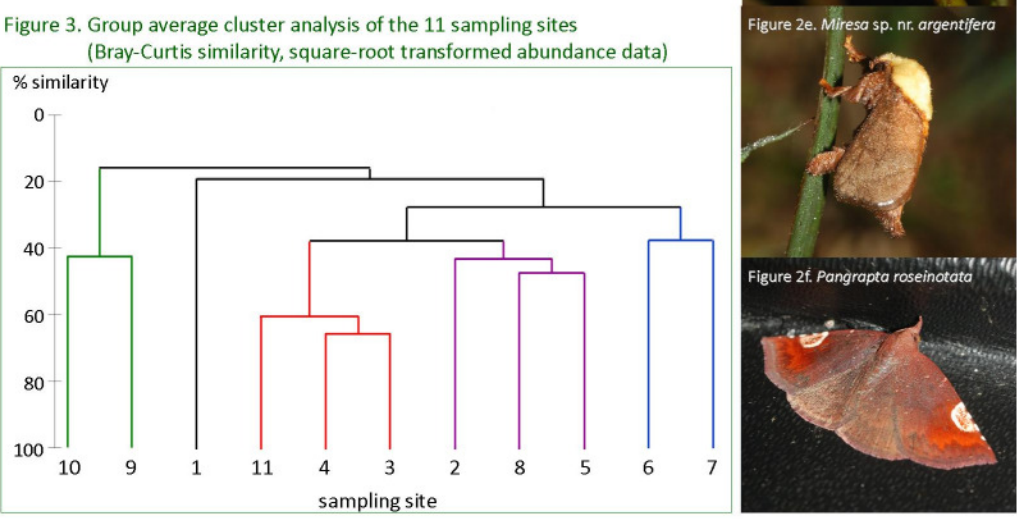


Table 3: summary of moth diversity at light trapping survey sites within KFBG (abundance data 1994, 2001-09)

Site number	No. of surveys	Species richness <i>S</i> _{total} / <i>S</i> _{mean} ± 1 s.d.	Evenness <i>J'</i>	Diversity index		Number of pIUCN Red List spp.			
				Fisher's α _(agg)	Shannon / <i>H'</i> (log _e)	CR	EN	VU	NT
1	3	111 / 45 ± 10	0.891	78.6	4.195	0	0	0	3
2	9	374 / 62 ± 46	0.871	195.1	5.161	0	1	0	6
3	29	839 / 100 ± 52	0.845	246.1	5.691	2	5	4	11
4	45	1056 / 150 ± 67	0.855	266.7	5.950	2	6	6	14
5	7	415 / 83 ± 37	0.922	207.8	5.557	1	2	1	8
6	2	198 / 115 ± 2	0.937	152.1	4.955	1	0	0	6
7	2	215 / 112 ± 116	0.932	176.6	5.007	0	2	0	4
8	5	442 / 122 ± 75	0.826	183.5	5.029	0	2	2	6
9	1	94	0.911	73.3	4.143	0	0	0	3
10	1	99	0.745	54.0	3.404	0	0	0	0
11	13	741 / 196 ± 100	0.755	213.2	4.987	0	5	4	11
All KFBG	117	1332 [1371, all records, 1994 to present]				3	7	7	15

- Conclusions
- Interestingly, each site at KFBG has a distinct moth assemblage, with relatively low similarity between sites and very few species common to most or all sites.
 - Species meet IUCN criteria due to (a) threats of habitat loss and change adjacent to KFBG and in Hong Kong generally; (b) restricted distribution and (c) small population sizes.
 - To maintain the “threatened” species, each of these sites should be managed to maintain, improve or restore their natural biotic and abiotic characteristics, assuming these conditions are good for the current moth assemblages.
 - Species meeting IUCN Red List Criteria VU, EN or CR are distributed across **eight** of the 11 recorded sites, thus KFBG is of significance for the conservation of rare moth species; though so far, the Butterfly Garden, Misha’s Bungalow and the summit of Kwun Yum Shan appear to be the key KFBG sites for moths of conservation concern.
 - Further study of each species metapopulation dynamics is required to assess population viability, even though KFBG is the longest studied site for moths in Hong Kong.

Acknowledgements

For granting permission to collect moths in Hong Kong:
The Agriculture, Fisheries & Conservation Department, HKSAR Government

For providing assistance with species’ identification & distribution and literature:
Michael FIBIGER, Sir Anthony GALSWORTHY, Jeremy HOLLOWAY, Martin HONEY, Axel KALLIES, Ian KITCHING, Vladimir KONONENKO, Li Hou Hun, Mike SHAFFER, Mark STERLING, Kevin TUCK, WANG Min, YEN Shen Horn.

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BMNH The Natural History Museum, London
BPBM The Bernice P. Bishop Museum, Honolulu
CAS The California Academy of Sciences, San Francisco
CNIC The Canadian National Insect Collection, Ottawa
NMNH The National Museum of Natural History, Washington D.C.
NUIC Nankai University Insect Collection, Tianjin
SCAU South China Agricultural University, Guangzhou
TLF HKSAR Govt., Tai Lung Experimental Farm, Sheung Shui, Hong Kong.

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