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Butterfly extirpations, discoveries and rediscoveries in Singapore over 28 years

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Abstract. Habitat loss and urbanisation in the tropics have been recognised as major drivers of species extinctions. Concurrently, novel habitats such as urban parks have been shown to be important as habitats and stepping stones in urban ecosystems around the world. However, few studies have assessed long-term patterns of species extinctions and discoveries in response to these drivers in the tropics. We know little about long-term persistence and utility of novel habitats in tropical urban ecosystems. In this study, we produced an updated and exhaustive butterfly checklist of species recorded from Singapore till December 2017 to investigate trends in butterfly extirpations (local extinctions), discoveries (new country records) and rediscoveries and how these relate to land use change in 28 years (1990–2017) in Singapore. Up to 144 butterfly species were identified to be extirpated in Singapore by 1990. From 1990–2017, an additional nine butterfly extirpations have potentially occurred, which suggests a maximum of 153 butterfly extirpations to date. The rate of extirpations between 1990 to 2017 (< 0.33 extirpations per year) was much lower than the rate of extirpations between 1926 to 1989 (> 1.52 extirpations per year). The majority of potentially extirpated butterflies between 1990 to 2017 were species restricted to mature forests. Over this period, 51 new species were discovered, while 65 species were rediscovered, which collectively represent 24% of the total and 35% of the extant butterfly fauna of Singapore. Interestingly, 33% of discovered species were only observed in degraded secondary forests or urban parks in Singapore, the former maturing with age and the latter having increased in area during the same time period. We hypothesise that the current slowdown in butterfly extirpations may be representative of habitat recovery and/or improved habitat connectivity, lower undetected extirpations, and/or lengthening of extinction debts. A slowdown in extirpations and an increased utilisation of novel habitats by discovered species present a window of conservation opportunity to restore native habitats and increase habitat connectivity among existing patches of managed vegetation.

Key words. extinction, fragmentation, habitat degradation, Lepidoptera, Southeast Asia, urban ecology

INTRODUCTION

The tropical island of Singapore has undergone significant changes in vegetation cover since 1819 (Corlett, 1992; O'Dempsey, 2014). Only 0.5% of primary forest, ~ 1.5% of freshwater swamp forest and old secondary forest cover now remain (Yee et al., 2011); natural vegetation has been fragmented for over 100 years (Corlett, 1992) and the island continues to face increasing anthropogenic pressure (Chong et al., 2014).

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Singapore has perhaps the best documented butterfly fauna in Southeast Asia. Catastrophic extirpations (population extinctions in Singapore and not global extinctions) have been reported for butterflies from Singapore as a result of extreme historical deforestation events (Brook et al., 2003; Turner et al., 1994). Past estimations of extirpation patterns and rates in Singapore, however, inferred extirpations on the assumption that all lowland forest species of Peninsular Malaysia can be found in Singapore (Brook et al., 2003), which is not necessarily the case.

It is timely for an update due to several contributing factors. Firstly, 52 extirpations known at that time from Singapore were overlooked by Brook et al. (2003) and Koh et al. (2004) (see Appendix S1 for details). Secondly, over the past 70–80 years, Singapore has witnessed the emergence of novel habitats as abandoned cultivated lands have since regenerated into secondary forests and scrublands (Corlett, 1992). These now constitute up to ~28% of the island area (Yee et al., 2011). In addition, there have been many urban-greening initiatives in Singapore since the 1990s (Tan, 2006; Jain et al., 2012). Networks of urban parks and community gardens have been consciously created in the past three decades to expand potential habitats for species enhanced by plantings of butterfly host and nectar plants (Jain et al.,

2012; NParks, 2017; Tan, 2006; Wang et al., 2017). While important nature areas continue to be lost to development even in the past two decades, e.g., Senoko (Ho, 1996) and Lorong Halus wetlands (Lim, 2000), Singapore's overall green cover has marginally increased since the 1990s due to an increase in coverage of managed green spaces (Corlett, 1992; Yee et al., 2011). Last but not least, a large number of new species discoveries (new country records) and rediscoveries of species previously considered as extirpated (locally extinct) have been documented from Singapore in the last decade in the non-peer reviewed literature (Appendix S2) which we summarise here.

Singapore's vegetation cover history has been dynamic, with the clearance of primary forest but recent increases in secondary forest and managed vegetation. We have recently demonstrated (as has Koh & Sodhi, 2004) that there are species-habitat relationships, with primary and mature secondary forests providing optimal habitat for butterflies, but small forest fragments in Singapore continue to retain a number of rare species (Jain et al., 2017). This leads us to believe that the new species discoveries, rediscoveries and extirpations may be related to changes in vegetation cover.

The objectives of this paper are to (1) produce an updated and exhaustive butterfly checklist of species recorded from Singapore till December 2017; (2) document and estimate the number of potential species extirpations, discoveries and rediscoveries for butterflies in Singapore from 1990–2017 (28 years) and (3) quantify and compare the habitat use of potentially extirpated, discovered and rediscovered species during the review period.

Understanding the habitat use of potentially extirpated species can be useful in crafting species restoration plans for Red List species (Davison et al., 2008). Additionally, a better understanding of the ecology of the discovered species can be useful in developing future species action plans and management interventions to conserve these newly discovered butterfly populations.

MATERIALS AND METHODS

The term 'extirpations' in this paper refers to local population extinctions from Singapore and not global extinctions. Similarly, 'discoveries' refer to discoveries of previously unknown local populations (new country records) or discoveries of species previously thought extirpated from Singapore and not discoveries of species new to science. To evaluate the number of extirpated and discovered (i.e. new species discoveries and rediscoveries) butterfly species recorded from Singapore between 1990 to 2017, we reviewed species records in all major documentation of the butterfly fauna of Singapore to date, including – Corbet & Pendlebury (1992), Ng & Wee (1994), Khew & Neo (1997), Davison et al. (2008), and Khew (2008, 2010, 2015). This review was supplemented with new information by butterfly sightings and specimen records compiled since 1990 with the help of ~ 30 local experts from the Butterfly & Insect Group of the Nature Society (Singapore) and ButterflyCircle Singapore (including the authors of this paper: A. Jain, S. K. Khew and C. W. Gan). These experts have kept presence/absence records of butterfly species collated from systematic surveys as well as incidental surveys and opportunistic visits across numerous sites in Singapore since the 1970s and 1980s.

The historic butterfly checklist for Singapore (hereafter 'historic checklist') was prepared by Corbet & Pendlebury (1956) who classified species as extirpated if they were not recorded from Singapore for at least 30 years (Corbet & Pendlebury, 1956). After publication of the historic checklist, new species records for Singapore were added by Fleming (1975). Thereafter, Khew & Neo (1997) added species based on field surveys from the year 1990 to 1997. Finally, the list of extirpated and extant species was updated for Singapore Red Data book in 1994 (Ng & Wee, 1994) and 2008 (Davison et al., 2008).

For the current butterfly checklist, we classified species as extirpated if they were not recorded in Singapore over a 28-year time period (1990–2017). Comparisons could not be made over a 30-year period (1988–2017), unlike Corbet & Pendlebury (1956), due to the lack of data from 1988–1989. To define the upper limit to the number of extirpations during 1990–2017, species with single individual sightings since the year 1990 and no sighting records from 2008–2017 (10 years) were considered as 'potentially extirpated' species. There has been an increase in survey effort (systematic and incidental surveys) in the last 10 years and yet the species (considered as extirpated) has not been detected and thus it is reasonable to say that the species is likely to be extirpated. Rediscovered species were reported extirpated prior to 1990 (i.e. not recorded for more than 30 years in Singapore before 1990). Such species were recorded at least once between 1990 to 2017.

Species that were regularly sighted (every year in most cases) in time and/or space were considered as resident species. Breeding activity and life-cycle stages of a majority of these species have been recorded from Singapore. Vagrants referred to species documented only from sporadic sightings of up to three individuals (e.g., *Vanessa cardui*) from 1990–2017 and with no breeding records in Singapore. Species that had more than three sporadic sightings during the same time period and in some occasions ephemeral sightings of individuals of a species over a few days from one locality but with no local breeding record were recorded as migrants (e.g., *Appias lyncida vasava*). The main distinction between potentially extirpated and vagrant (or migrant) species was that potentially extirpated species were extant 10 years ago (prior to 2008) but vagrants (or migrants) were either never recorded before or have been declared extirpated for more than 50 years. Previous butterfly checklists in Singapore either did not make or made an ambiguous distinction between resident, vagrant and migrant species. Therefore, to ensure consistency with previous checklists, we had to include vagrants and migrants as extant species in our assessment of species extirpations. However, we report resident, migrant and vagrant species separately (Table S1) for the checklist to serve as a potential baseline for future

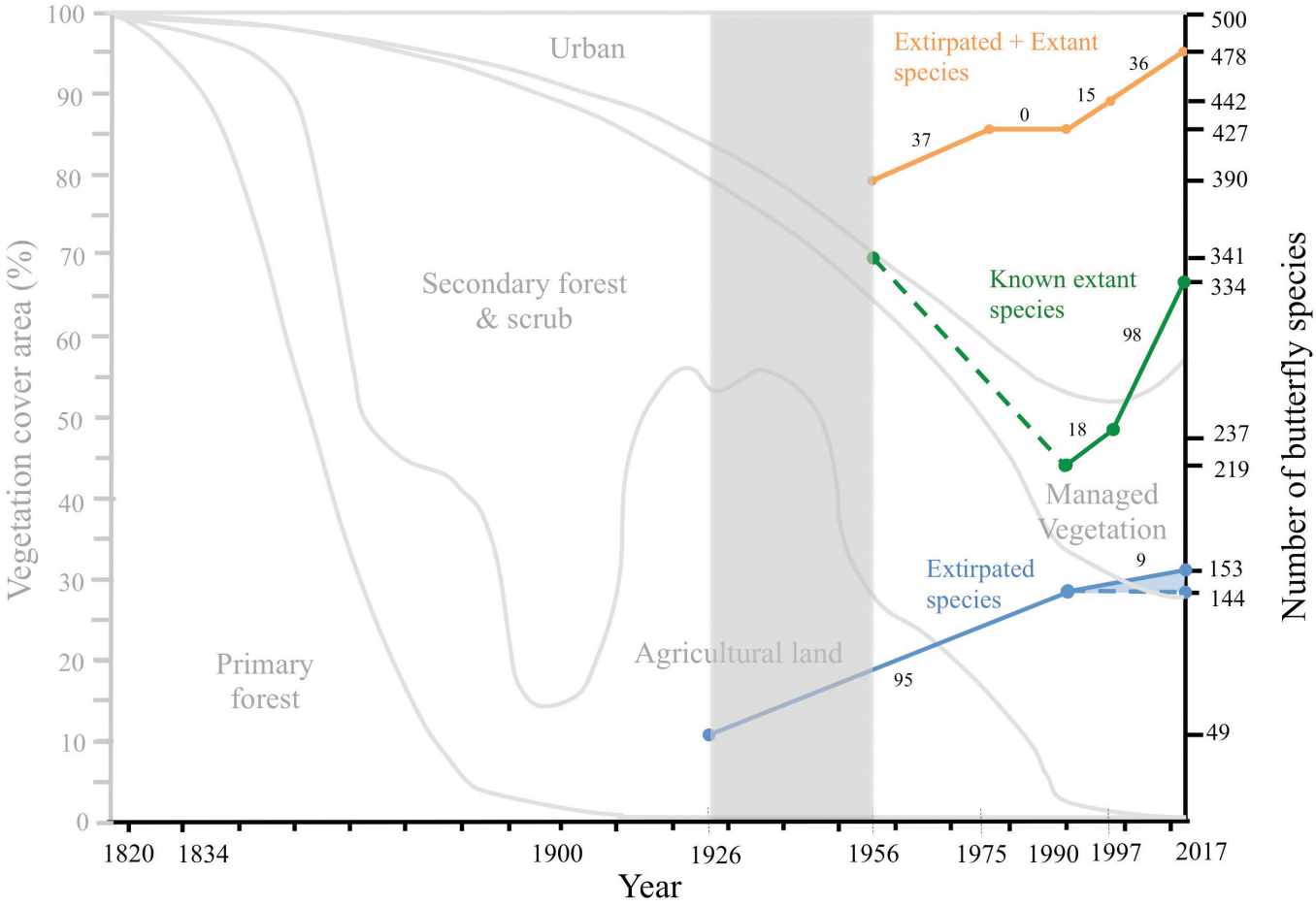

Fig. 1. Vegetation cover change and the number of butterfly species in Singapore from 1819–2017. The percentages of vegetation cover change from 1819–1990 were extracted with permission from Corlett (1992) and extended till 2017 using Yee et al. (2011) and NParks (2017). Agricultural land included tree crops such as rubber; managed vegetation included parks, gardens, and turf. The vegetation cover area under each habitat type was calculated by the area between any of the two vegetation cover lines marked in grey. Species were defined as extirpated in 1956 if they were not recorded for 30 years (shown in grey rectangle) by Corbet & Pendlebury (1956). Forty-nine and 144 butterfly species were not recorded since 1926 and 1990 respectively as shown by the blue line. Nine species could be additionally ('potentially') extirpated since 1990 (as indicated by the blue shaded area). An increase in the number of extirpated & extant species was due to new species discoveries (new country records) and rediscoveries since 1956. Fleming (1975, 1991) added new country records till 1975, but they did not report any extirpations. Therefore, the number of extant species in 1975 was unknown (as indicated by the green dotted line).

research. Subspecies (e.g., *Hypolimnas bolina bolina* vs. *Hypolimnas bolina jacintha*) were not counted as separate species. Species were classified as cryptic if they could be easily confused visually with other similar looking species in Singapore during field identification.

Lastly, to relate changes in vegetation cover types with the number of species extirpations and discoveries, data on the habitat use of species was compiled from published butterfly sightings (Jain et al., 2017; Khew & Neo, 1997) and several unpublished records maintained by local butterfly experts since 1990. Species extirpations and discoveries were evaluated in relation to the following vegetation types – primary and old secondary forest (collectively refered to as mature forest), young secondary/degraded forest and urban parks (see Jain et al., 2017; Yee et al., 2011 for definitions). Data on the relative areas (percentages) occupied by different vegetation cover types (primary and secondary forest, cultivated land and urban) in Singapore since 1819 was extracted from Corlett (1992) and extended till 2017 using Yee et al. (2011) and NParks (2017) (see Fig. 1). Previous checklists were corrected with updated taxonomy, and past extirpations were corrected for species rediscoveries.

RESULTS

Extirpated and extant butterflies in 28 years. A total of 478 butterfly species have been recorded from Singapore by the end of 2017 (Table 1, 2, S1, Fig. 1). In the 28 year period between 1990–2017, 144 species (30% of all recorded species) were not observed and thus considered as extirpated. It should be noted that all of these 144 species were also considered as extirpated by Khew (2008), Khew & Neo (1997) or Corbet & Pendlebury (1992) based on surveys in the 1970s and 1980s and therefore, in essence, have not been recorded in Singapore for more than 30 years. Of the remaining 334 species (extant species), nine species were represented by single individual sightings since 1990 and were not sighted at all from 2008–2017 (10 years). These were considered to be potentially extirpated (Table 3). A

Table 1. Species extirpations and discoveries (new species discoveries and rediscoveries) in Singapore for butterflies. * Potential extirpations were defined as single specimen records in 28 years (1990–2017) and no sighting/record for past 10 years (2008–2017). The values in parentheses refer to the fraction of the total number of butterfly species recorded in Singapore till the end of 2017.

Time period	Years	No. of years	No. of extirpations	Extirpation rate	No. of discoveries	Discovery rate
Historical	1926–1989	63	95 (22%)	1.51	–	–
Current	1990–2017	28	9 (2%)*	0.33	116 (24%)	4.14

Table 2. Number of butterfly species recorded in each family from Singapore. Numbers in parentheses are the number of species believed to be potentially extirpated in 28 years (1990–2017). Numbers in square brackets are the number of species that have been rediscovered during this time period. Extant species have been corrected for species that were extant but missed by the authors of that list.

Family	Historic (C&P 1956)	Khew & Neo (1997)*	Khew (2008)**	Khew (2010)	Khew (2015)	Current study
Papilionidae	1	3 [1]	3 [1]	3 [1]	2	2
Pieridae	1	9 [3]	9 [3]	8 [2]	6	6
Nymphalidae	20 [4]	45 [13]	40 [8]	39 [6]	36 [3]	33
Riodinidae	1	4 [1]	2	2	2	2
Lycaenidae	19 [1]	103 [27]	91 [17]	81 [5]	78 [3]	76
Hesperiidae	17 [5]	42 [17]	35 [12]	31 [6]	28 [2]	25
TOTAL EXTIRPATED	59 [10]	206 [62]	180 [41]	164 [20]	152 [8]	144
Papilionidae	14	13	14	14	18	18
Pieridae	21	15	16	17	22	22 (1)
Nymphalidae	90	79	86	88	95	99 (2)
Riodinidae	6	3	5	5	5	5
Lycaenidae	139	79	94	106	111	113 (3)
Hesperiidae	61	48	59	65	69	77 (3)
TOTAL EXTANT	331	237	274	295	320	334 (9)
TOTAL EXTANT + EXTIRPATED	390	443	454	459	472	478

*Khew & Neo (1997) had originally omitted 52 species that were already listed extirpated from Singapore by Corbet & Pendlebury (1992) and a further of 9 species that were listed as extant by Fleming (1975). These were added in this table. For details see species with 'NLEX' and 'NLEA' classification in Table S1.

**Khew (2008) had omitted 36 species that were already known from Singapore in 2008. These were added in this table. Also see species with 'NLEA' and 'NLEX' classifications in Table S1.

C&P 1956 = Corbet & Pendlebury (1956)

total of 301 species were found to be residents, five species were migrants and 19 species were considered as vagrants (Table S1).

Using the year 2017 as the cut-off date for our assessment, if the nine potentially extirpated species were also considered extirpated, then a total of 153 butterfly species would have been extirpated by 2017 (Fig. 1). This implies an extirpation rate of < 0.33 extirpations per year since 1990. A majority (seven out of nine species) of the potentially extirpated species in Singapore was restricted to mature forests (primary and old secondary forests; Fig. 2) and a majority (six out of nine species) were cryptic. Species of the families Lycaenidae and Nymphalidae suffered the largest number of extirpations and the highest proportions of extirpations compared to other families (extirpated/extirpated+extant species in that family; 40% for Lycaenidae and 25% for Nymphalidae; Table 2). This result was in agreement with previous analyses on butterfly extirpations which showed that species of families Lycaenidae and Nymphalidae were the most prone to extirpation (Koh et al., 2004).

Butterfly extirpations before 1990. Corbet & Pendlebury (1956) reported 59 out of 390 butterfly species as extirpated in Singapore; however, 10 of these have since been rediscovered. In light of these rediscoveries, only 49 species, therefore,

Table 3. Potential butterfly species extirpations in Singapore from 1990–2017. Last sightings of these species were single specimen sightings and > 10 years ago. Abbreviations: M = Primary and mature (old) secondary forest; D = Degraded (young) secondary forest and scrub; U = Urban parks. Cryptic species: Y = Yes, N = No.

S. No	Scientific Name	Common Name	Last Sighting	Habitats Utilised	Cryptic Species
	Family: Pieridae, Subfamily: Pierinae				
1	*Delias pasithoe parthenope*	Red base jezebel	Early 1990s	M	N
	Family: Nymphalidae, Subfamily: Satyrinae				
2	*Elymnias penanga penanga*	Pointed palmfly	1990s	M, D	Y
3	*Ypthima fasciata torone*	Scarce six ring	2004	M	Y
	Family: Lycaenidae, Subfamily: Miletinae				
4	*Miletus gopara gopara*	Round-band brownie	1998	M, D	Y
	Family: Lycaenidae, Subfamily: Polyommatinae				
5	*Castalius rosimon rosimon*	Common pierrot	Early 1990s	M	N
6	*Iraota distanti distanti*	Spotted silverstreak	1999	M	N
	Family: Hesperiidae, Subfamily: Pyrginae				
7	*Gerosis limax dirae*	Black and white flat	2001	M	Y
8	*Gerosis tristis*		2004	M	Y
9	*Gerosis phisara phisara*		No recent record	M	Y

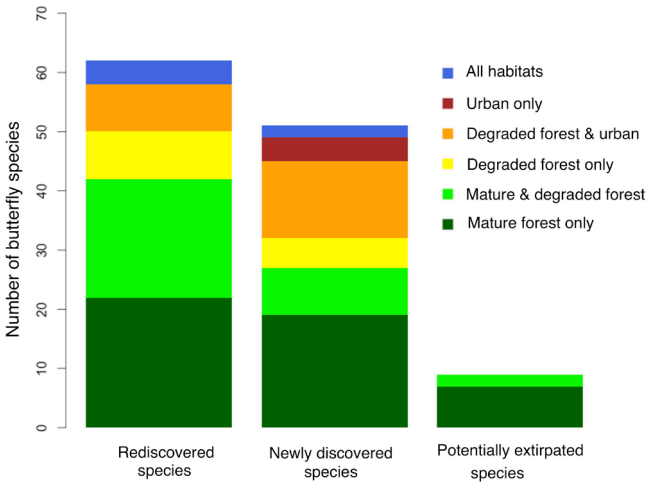

Fig. 2. Distribution of newly discovered and rediscovered species, and potentially extirpated species of butterflies in Singapore between 1990 and 2017. Species were classified according to the habitat types in which they were recorded. See Table 3 and Table 4 for the detailed list.

were truly extirpated by 1956. Khew & Neo (1997) had suggested 206 species were extirpated based on surveys from 1990–1997, of which 62 species have since been rediscovered. Therefore, the actual number of extirpations by 1990 was no more than 144 species (Table 2). The majority of butterfly extirpations (95 species = 144 – 49 species) in Singapore occurred from the year 1926 to 1989 (Fig. 1) implying an extirpation rate of 1.51 extirpations per year during this period.

Butterfly discoveries and rediscoveries in 28 years. One hundred and sixteen species were discovered (new discoveries and rediscoveries) and added to the checklist from 1990–2017, implying a rate of 4.14 discoveries per year during this period. Of these 116 discoveries, 51 were new species discoveries and 65 were rediscoveries. Fifteen new discoveries and three rediscoveries were made from 1990–1997 (Khew & Neo, 1997; Table 4) whereas 36 new discoveries and 62 rediscoveries were made from 1997–2017 (Table 4).

Interestingly, only 41% (21/51) of the new species discoveries were cryptic in nature compared with 59% (38/65) of the rediscovered species that were cryptic. The majority of these rediscovered cryptic species belonged to the families Lycaenidae and Hesperiidae. Thirty-seven percent (19/51 species) of the new species discoveries were found to utilise urban parks in Singapore (Fig. 2). Of these 19 species found in urban parks, five were vagrants, one migrant, and at least six were newly established migrants (now residents) that were adapted to urban environments and/or edge species – *Acraea terpsicore*, *Cethosia cyane*, *Cirrochroa tyche rotundata*, *Zizeeria maha serica*, *Nacaduba biocellata*, *Cephrenes trichopepla*.

DISCUSSION

Vegetation cover change and extirpations. During the 19th century and early 20th century (1819–1920s), more than 99% of primary forests in Singapore were cleared, leaving behind a large proportion (70%) of Singapore covered with scrub, secondary forest or agricultural lands (Corlett, 1992; Fig. 1). These massive deforestation events that lasted for over 100 years (1819–1920s) only led to 49 documented extirpations for butterflies (this study) and 10 documented extirpations for birds as of the 1920s (Chasen, 1924; Chisholm et al., 2016) – a rather moderate loss of species compared to the loss in vegetation cover. An increase in butterfly extirpations (95 species) between 1926 and 1989

Table 4. Butterfly discoveries (new discoveries and rediscoveries) in Singapore from 1990–2017. Abbreviations: M = Primary and mature (old) secondary forest; D = Degraded (young) secondary forest and scrub; U = Urban parks; R = Rediscovered species; N = Newly discovered species. Cryptic species: Y = Yes, N = No.

S.No	Scientific name	Common Name	Current status	New/re-discovery	Sighted since	Habitats utilised	Cryptic species
Family: Papilionidae, Subfamily: Papilioninae							
1	*Troides amphrysus ruficollis*	Malayan birdwing	Vagrant	R	2011	D, U	N
2	*Papilio helenus helenus*	Red helen	Vagrant	N	2014	U	N
3	*Papilio prexaspes prexaspes*	Blue helen	Resident	N	1990s	M	N
4	*Graphium eurypylus mecisteus*	Great jay	Vagrant	N	2014	M	Y
5	*Graphium doson evemonides*	Common jay	Resident	N	2005	D	N
6	*Graphium bathycles bathycloides*	Striped jay	Vagrant	N	2010	M	Y
Family: Pieridae, Subfamily: Pierinae							
7	*Pareronia valeria lutescens*	Wanderer	Migrant	R	2011	D	N
8	*Saletara liberia distanti*	Malaysian albatross	Vagrant	R	2014	M	N
9	Prioneris philonome themana	Red spot sawtooth	Vagrant	N	2014	M	N
10	*Appias paulina distanti*	Lesser albatross	Vagrant	N	2014	U	N
11	*Appias indra plana*	Plain puffin	Vagrant	N	2012	Not enough data	N
12	*Hebomoia glaucippe aturia*	Great orange tip	Vagrant	N	2004	Not enough data	N
Family: Pieridae, Subfamily: Coliadinae							
13	*Eurema brigitta senna*	No brand grass yellow	Resident	R	2006	D	Y
Family: Nymphalidae, Subfamily: Danainae							
14	*Parantica aspasia aspasia*	Yellow glassy tiger	Vagrant	R	2008	D	N
15	*Tirumala septentrionis septentrionis*	Dark blue tiger	Migrant	N	2016	D, U	N
16	*Tirumala limniace*	Blue tiger	Vagrant	N	2016	D, U	N
17	*Ideopsis juventa sitah*	Grey glassy tiger	Vagrant	N	2014	D	Y
18	*Idea leuconoe chersonesia*	Mangrove tree nymph	Resident	R	Early 2000s	D	N
19	*Euploea tulliolus ledereri*	Dwarf crow	Resident	R	2002	M, D	N
Family: Nymphalidae, Subfamily: Satyrinae							
20	*Mycalesis perseoides perseoides*	Burmese bush brown	Resident	N	1990s	M, D	Y
21	*Thaumantis noureddin noureddin*	Dark jungle glory	Vagrant	R	2002	D, U	N
Family: Nymphalidae, Subfamily: Heliconiinae							
22	*Acraea terpsicore*	Tawny coster	Resident	N	2006	D, U	N
23	*Cethosia methypsea*	plain lacewing	Resident	R	1990s	M	N
24	*Cethosia cyane*	Leopard lacewing	Resident	N	2005	D, U	N

S.No	Scientific name	Common Name	Current status	New/re-discovery	Sighted since	Habitats utilised	Cryptic species
25	*Vagrans sinha sinha*	Vagrant	Vagrant	R	2013	M, D, U	N
26	*Cirrochroa tyche rotundata*	Common yeoman	Resident	N	2015	U	N
27	*Cirrochroa emalea emalea*	Malay yeoman	Resident	R	2013	M	N
Family: Nymphalidae, Subfamily: Biblidinae							
28	*Symbrenthia hippoclus selangorana*	Malayan jester	Migrant	N	2012	M, D	N
29	*Vanessa cardui*	Painted lady	Vagrant	N	2007	D, U	N
30	*Vanessa indica indica*	Indian red admiral	Vagrant	N	2008	D, U	N
31	*Ariadne ariadne ariadne*	Angled castor	Vagrant	R	2013	D	N
32	*Doleschallia bisaltide pratipa*	Autumn leaf	Resident	R	2000s	M, D	Y
Family: Nymphalidae, Subfamily: Limenitidinae							
33	*Athyma pravara helma*	Lance sergeant	Resident	N	1990s	M	Y
34	*Lexias dirtea merguia*	Dark (black tipped) archduke	Resident	N	1990s	M	Y
35	Neptis harita harita	Chocolate sailor	Resident	N	1990s	M	N
36	*Parthenos sylvia lilacinus*	Clipper	Vagrant	R	2013	M, D	N
37	*Euthalia merta merta*	White tipped baron	Resident	R	Early 2000s	M	Y
Family: Nymphalidae, Subfamily: Charaxinae							
38	*Charaxes solon echo*	Black rajah	Resident	R	2002	M	
39	*Polyura moori moori*	Malayan nawab	Vagrant	R	2012, 2014	D	Y
Family: Riodinidae, Subfamily: Riodininae							
40	*Abisara saturata kausambioides*	Malayan plum judy	Resident	R	Early 2000s	M, D	Y
41	*Taxila haquinus haquinus*	The harlequin	Resident	R	Early 2000s	D	N
Family: Lycaenidae, Subfamily: Miletinae							
42	*Liphyra brassolis abbreviata*	Moth butterfly	Resident	R	2009	M	N
Family: Lycaenidae, Subfamily: Polyommatinae							
43	*Megisba malaya sikkima*	The Malayan	Resident	N	1990s	M, D	N
44	*Zizeeria maha serica*	Pale grass blue	Resident	N	2001	D, U	Y
45	*Catochrysops panormus exiguus*	Silver forget-me-not	Resident	R	1990s	M, D	Y
46	*Jamides malaccanus malaccanus*	Malaccan caerulean	Resident	N	Early 2000s	M	Y
47	*Jamides alecto ageladas*	Metallic caerulean	Resident	R	2008	D	Y
48	*Jamides elpis pseudelpis*	Glistening caerulean	Resident	R	Early 2000s	D, U	Y
49	Nacaduba angusta kerriana	White fourline blue	Resident	R	2008	M	Y

S.No	Scientific name	Common Name	Current status	New/re-discovery	Sighted since	Habitats utilised	Cryptic species
50	*Nacaduba sanaya elioti*	Jewel fourline blue	Resident	R	2008	M	Y
51	*Nacaduba pactolus odon*	Large fourline blue	Resident	R	2009	M, D, U	Y
52	*Nacaduba kurava*	Transparent six-line blue	Resident	R	After 2010	M, D	Y
53	*Nacaduba pavana singapura*	Singapore fourline blue	Resident	R	2011	M	Y
54	Nacaduba calauria malayica	Malayan dark six-line blue	Resident	R	2000s	M, D	Y
55	*Nacaduba biocellata*	Two spotted line blue	Resident	N	2004	D, U	N
56	*Prosotas dubiosa lumpura*	Tailless line blue	Resident	R	2008	M, D, U	Y
57	*Prosotas lutea sivoka*	Banded line blue	Resident	N	2013	D	Y
58	*Prosotas aluta nanda*	Barred line blue	Resident	N	2008	M	Y
59	*Catopyrops ancyra*	Ancyra blue	Resident	N	2004	D, U	Y
60	*Petrelaea dana dana*	Dingy line blue	Resident	N	2005	D, U	Y
Family: Lycaenidae, Subfamily: Theclinae							
61	*Arhopala major major*	Major yellow oakblue	Resident	N	1990s	M	Y
62	*Arhopala muta maranda*	Mutal oakblue	Resident	R	2010	M	Y
63	*Arhopala alitaeus pardenas*	Purple broken-band oakblue	Resident	R	2011	M	Y
64	Arhopala sublustris ridleyi		Resident	R	After 2010	M, D	Y
65	*Arhopala silhetensis adorea*	Sylhet oakblue	Resident	R	2008	M	Y
66	*Arhopala eumolphus maxwelli*	Green oakblue	Resident	R	2007	M	N
67	*Iraota distanti distanti*	Spotted silverstreak	Potentially extirpated	N	1990s	M	N
68	*Catapaecilma major emas*	Gray tinsel	Resident	R	2000s	M, D	N
69	*Pratapa deva relata*	White royal	Resident	R	2008	M, D	Y
70	*Tajuria mantra mantra*	Felder's royal	Resident	R	2000s	M, D	Y
71	*Tajuria dominus dominus*	Sovereign royal	Resident	R	2000s	M, D	Y
72	*Rachana jalindra burbona*	Banded royal	Resident	R	2000s	M, D	N
73	*Manto hypoleuca terana*	Green imperial	Resident	R	2008	M	Y
74	*Pseudotajuria donatana donatana*	Golden royal	Resident	R	2000s	M, D	N
75	*Ancema blanka blanka*	Silver royal	Resident	R	2000s	M,D	N
76	*Deudorix elioti*	Eliot's cornelian	Resident	R	2002	M	Y
77	*Deudorix staudingeri*	Large cornelian	Resident	R	2012	M	Y
78	*Sinthusa nasaka amba*	Narrow spark	Resident	N	1990s	M	N
79	*Bindahara phocides phocides*	The plane	Resident	R	2000s	M	N
80	*Rapala pheretima sequeira*	Copper flash	Resident	R	2000s	M, D	Y

S.No	Scientific name	Common Name	Current status	New/re-discovery	Sighted since	Habitats utilised	Cryptic species
Family: Hesperiidae, Subfamily: Coeliadinae							
81	Bibasis sena uniformis	Orange-tail awl	Resident	N	2002	M	N
Family: Hesperiidae, Subfamily: Pyrginae							
82	*Pseudocoladenia dan dhyana*	Fulvous pied flat	Resident	N	2002	M, D	N
83	*Mooreana trichoneura trichoneura*	Yellow flat	Resident	N	2012	M, D	N
84	*Celaenorrhinus asmara asmara*	White banded flat	Resident	R	2011	M, D	N
85	Gerosis phisara phisara		Potentially extirpated	N	1990s	M	Y
86	*Gerosis tristis*		Potentially extirpated	R	2004	M	Y
87	*Tagiades ultra*	Ultra snow flat	Resident	R	1990s	M	Y
88	*Tapena thwaitesi bornea*	Black angle	Resident	N	1990s	M	N
Family: Hesperiidae, Subfamily: Hesperiinae							
89	*Hyarotis microsticta*	White club flitter	Vagrant	N	2015	D	Y
90	*Salanoemia tavoyana*	Yellow streak darter	Resident	N	2011	D	N
91	*Taractrocera archias quinta*	Yellow grass dart	Resident	N	2005	D, U	Y
92	*Oriens paragola*	Malay dartlet	Resident	N	2011	M, D	Y
93	*Potanthus ganda*		Resident	N	2013	Not enough data	Y
94	*Cephrenes trichopepla*	Yellow palm dart	Resident	N	2010	U	N
95	*Telicota linna*	Linna palm dart	Resident	N	2007	D, U	Y
96	*Pelopidas assamensis*	Great swift	Resident	N	2002	M, D, U	Y
97	*Pelopidas conjunctus conjunctus*	Conjoined swift	Resident	N	2005	D, U	Y
98	*Astictopterus jama jama*	Forest hopper	Resident	R	2000s	M, D	N
99	*Zographetus doxus*	Spotted flitter	Resident	R	2000s	M	N
100	*Zographetus ogygia ogygia*	Purple spotted flitter	Resident	R	2013	M, D	N
101	*Pemara pugnans pugnans*	Pugnacious lancer	Resident	R	2000s	M	N
102	*Gangara lebadea lebadea*	Banded redeye	Resident	R	2008	M	N
103	*Zela storeyi* (or *Zela zenon*)	Detritus (Storeyi's palmer)	Resident	N	1990s	M	N
104	*Taractrocera ardonia lamia*	Spotted grass dart	Resident	N	1990s	M, D	N
105	*Potanthus trachala tytleri*	Detached dart	Resident	R	2011	M, D	Y
106	*Potanthus serina (or Potanthus hetaerus serina)*	Large dart	Resident	R	2010	M, D	Y
107	*Suastus everyx everyx*	White palm bob	Resident	N	1990s	M	N
108	*Suastus gremius gremius*	Palm bob	Resident	N	1990s	M, D, U	N
109	*Cephrenes acalle niasicus*	Plain palm dart	Resident	R	2010	D, U	Y
110	*Telicota colon stinga*	Common palm dart	Resident	R	2010	D, U	Y

S.No	Scientific name	Common Name	Current status	New/re-discovery	Sighted since	Habitats utilised	Cryptic species
111	*Telicota augias augias*	Palm dart	Resident	R	2000s	D, U	Y
112	*Borbo cinnara*	Formosan swift	Resident	R	2010	D, U	Y
113	*Pelopidas agna agna*	Bengal swift	Resident	R	2010	D, U	Y
114	*Baoris farri farri*	bamboo Paintbrush swift	Resident	R	2000s	Not enough data	Y
115	*Baoris oceia*	Paintbrush swift	Resident	R	2000s	Not enough data	Y
116	*Caltoris malaya*	Malayan swift	Resident	R	2014	M, D, U	Y

is likely due to the urbanisation of Singapore as large tracts of agricultural land were converted into other land uses such as public housing and industrial estates. Koh et al. (2004) found that butterfly species with high larval host plant specificity and high adult habitat specialisation (i.e. forest dependence) were the best correlates of extirpation risks in Singapore. Limited dispersibility is also another important cause of local butterfly extirpations in the tropics (Basset et al., 2015). Disturbance sensitive species would have likely been extirpated with the loss of preferred habitat and with it the larval host plants, in addition to their limited ability to disperse through urban areas. A similar trend was also observed in Europe where a period of land-use intensification and habitat loss between 1930–1990 led to species declines and biotic homogenisation across many pollinator groups and plants (Carvalheiro et al., 2013).

Undetected extirpations. The relatively low number of documented extirpations in Singapore as of the 1920s may be due to insufficient inventorying efforts in the earlier years which may have led to high undetected extirpations. Inventorying efforts for butterflies started since 1834 – soon after large-scale deforestation began in 1819 (Corbet & Pendlebury, 1992). But a high rate of species discoveries (rediscoveries and new country records) for butterflies from 1990–2017 suggests poor-quality historic baseline for butterflies, and that undetected extirpations for butterflies may be high and possibly more so than birds (Chisholm et al., 2016 predicted only 5 undetected bird extirpations in Singapore from 1819–1920s). More research is needed to calculate undetected extirpations for butterflies – similar to Chisholm et al. (2016), so that a more accurate estimation of extirpation rates can be made for comparisons between historic and current time periods. This would improve our evaluation of the actual impacts of land use change (e.g., urban development) on butterfly assemblages in the future.

Slowdown in butterfly extirpations since 1990. Only nine potential butterfly extirpations have been recorded since 1990, suggesting a slowdown in butterfly extirpations in 28 years (1990–2017). This may be indicative of signs of habitat recovery as secondary forests in Singapore have aged, managed vegetation cover (urban parks) has increased (Fig. 1) and forests have benefited from increased connectivity by park connectors (e.g., *Troides helena* and *Pachliopta aristolochiae* butterflies have been downlisted from 'endangered' status (Ng & Wee, 1994) to 'vulnerable' status (Davison et al., 2008) as a result of the plantings of their host plants in urban parks and gardens across Singapore). Such changes observed in our study appear to be consistent with the trend observed for butterflies and other pollinator insect groups in Europe where species richness declines and biotic homogenisation have reduced since increased conservation investment started in 1990 (Carvalheiro et al., 2013).

A slowdown in extirpations should, however, be interpreted with caution because signs of habitat recovery could be a result of the lengthening of extinction debts. Habitat loss can lead to immediate population extirpations, or populations can go through a combination of deterministic and stochastic processes that can cause a time lag in extirpations ("extinction debt"; Wearn et al., 2012). Extinction debts have been reported to be particularly high (i.e. several decades long) if a landscape retains large habitat patches and high connectivity even after severe habitat loss (Brooks et al., 1999; Ferraz et al., 2003). In such cases, populations may be just below their extinction threshold (commonly referred to as minimum viable populations; Traill et al., 2007) and further habitat loss or loss of connectivity, may lead to extirpations of these populations. Large extinction debts of plants (Vellend et al., 2006) may also have cascading impacts on butterflies at both the larval and nectarivorous adult stage because butterflies are critically dependent on their larval host plants and nectar plants (e.g., *Troides helena* and *Pachliopta aristolochiae* butterflies were nearly extirpated as a result of the decline of their native host plant *Aristolocia jackii* in Singapore; A. J., unpublished data), some of which can be slow-growing trees.

Alternatively, a slowdown in butterfly species extirpations may also be partly due to a reduction in the number of undetected extirpations because of increased survey effort between 1990 to 2017. Indeed, species detection rates have been known to show peaks and troughs at time scales that tend to be associated with the monitoring activities of experts or funding events (Chisholm et al., 2016).

Lastly, an extirpation slowdown may also be indicative that the remaining butterfly assemblage is relatively better adapted to degraded and/or fragmented habitats following the rapid loss of extirpation prone species (forest dependent and larval host plant specific; Koh et al., 2004) from 1926–1989. Increasing use of pesticides in urban areas also

has long-term detrimental impacts on butterflies and other insects (Muratet & Fontaine, 2015) but this has not been quantified in Singapore.

Increase in butterfly discoveries since 1990. An increase in new species discoveries and rediscoveries between 1990 to 2017 can be attributed to several possible explanations. The majority of discoveries of previously overlooked cryptic taxa can be attributed to greater effort in inventorying, specimen collecting and photographic documentation by collaborations with citizen scientists in recent decades. Many butterfly identification resources are now available in Singapore, which helps sustain interest in butterfly inventorying by citizen scientists: two butterfly field-guides (Gan & Chan, 2008; Khew, 2015), a caterpillar field-guide (Tan & Khew, 2012), a mobile butterfly identification app with > 5,000 downloads (NSS iPhone App, 2012) and a popular butterfly blog (www.butterflycircle.blogspot.sg) with > 2.3 million views since 2004. Some recently discovered species may also be the subject of past misidentification by museums, which is not uncommon for cryptic taxa (e.g., 58% of African gingers had wrong names in 40 herbaria worldwide; Goodwin et al., 2015).

A significant number (33%) of discovered species were also found to utilise degraded secondary forests or urban parks, suggesting the usefulness of these novel and human-disturbed habitats to butterflies (Koh & Sodhi, 2004; Jain et al., 2012). Ironically though, some of these butterfly species (*Nacaduba biocellata*, *Cephrenes trichopepla*) may have been accidentally introduced in Singapore with their non-native ornamental larval host plants being used in the landscaping industry, a trend also observed in other parts of the world (Graves & Shapiro, 2003; DiTommaso & Losey, 2003).

Butterfly populations in Singapore may also be interacting with populations in Peninsular Malaysia which is only separated by the narrow Johore Straits as has been hypothesised for Oriental pied hornbills *Anthracoceros albirostris* (Banwell & Lim, 2009) and wild pigs *Sus scrofa* (Yong et al., 2010). This may influence the numbers and rates of butterfly extirpations and discoveries in Singapore as species recently extirpated may be offset by recolonisations. While immigration or recolonisation events between the two countries cannot be dismissed, there is no direct evidence to date or study to support this hypothesis.

Need for long-term inventorying and monitoring. Studies like these are uncommon in tropical Asia and ours is one of the few to address the issue of species rediscoveries. This was only possible because of carefully kept records in the past century for butterflies. The study corroborates that long-term inventorying is necessary for uncovering species extirpation trends and discovering new species. Long-term population trends are also critical in identifying the detection of early warning signals (e.g., a temporary excess of rare species in the community before population collapse; Hanski & Ovaskainen, 2002) so appropriate conservation interventions can be directed to such taxa.

Singapore has one of the best-studied bird (Castelletta et al., 2005; Chisholm et al., 2016) and butterfly (this study; Khew, 2015) faunas in the tropics. Yet, a large number of new species discoveries and rediscoveries from 1990 to 2017 suggest that even well studied tropical areas such as Singapore may have its biodiversity under-sampled, a problem stemming from cryptic diversity. This can have profound conservation implications (Bickford et al., 2007). Further research should tackle the issue of robust sampling and develop conservation management strategies that take into account cryptic diversity. A commitment to establish a reference collection of butterfly specimens and making voucher specimens accessible for taxonomic work as well as a plan to incorporate genomic data in butterfly conservation is also necessary. The later has been shown to be key to identify adaptive genetic variation and delineate conservation units effectively especially for rare and endangered species (Funk et al., 2012). Finally, continued engagement with committed citizen scientists seems to be the way forward to maintain public interest and sustain monitoring efforts in highly biodiverse tropical regions like Singapore.

CONCLUSION

Besides providing the most exhaustive and updated butterfly checklist of Singapore, our study presents a comparison of butterfly extirpations and discoveries between the current (1990–2017) and historical time period (1926–1989) in Singapore. We show how temporal trends in butterfly extirpations and discoveries in Singapore relate to changes in vegetation cover and particularly recent greening efforts. With over one-third (35%) of extant butterflies in Singapore consisting of new discoveries (15%) and rediscovered species (20%) since 1990, our study highlights how conservation management for butterflies in urban landscapes needs to be highly adaptive — one that needs to respond to a near continuous rate of discovery of new populations. We also highlight that future research should be directed to uncover future cryptic diversity.

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APPENDIX

Appendix S1. Limitations with previous butterfly assessments.

Brook et al. (2003) used Khew & Neo (1997)'s dataset to calculate 'recorded' butterfly extirpations and Corbet & Pendlebury (1992)'s dataset to calculate 'inferred' (undetected) butterfly extirpations with the assumption that all lowland forest species from Peninsular Malaysia would be present in Singapore prior to 1819 and would thereby constitute the pristine butterfly fauna of Singapore. This assumption is inaccurate because: i) Peninsular Malaysia is more than 200 times the size of Singapore which means that Singapore will support less species than Peninsular Malaysia by virtue of area effects; and ii) butterfly species distributions in Peninsular Malaysia are patchy and that some butterfly species are known to have different subspecies in Singapore and Peninsular Malaysia (Corbet & Pendlebury, 1992). Also, the number of 'recorded' extirpations by Brook et al. (2003) as well as Koh et al. (2004) were underestimates because they used a single data source (Khew & Neo, 1997) for their analyses which listed 381 species from Singapore and overlooked Corbet & Pendlebury (1992) which had reported an additional 52 extirpations. Another point of inconsistency was the difference in time frames of the studies. Khew & Neo (1997)'s study was based on field surveys that spanned 7 years (1990–1997) and although the authors (Khew & Neo) calculated extirpations over a 22 year period (1975 to 1997) using Corbet & Pendlebury (1975) as a reference, no data was available between 1975–1990 at the time of their publication.

Appendix S2. List of references used in Table S1 other than those listed in References in main text. (All electronic references were accessed on 31 December 2016).

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Table S1. Checklist of all butterflies recorded from Singapore to date.

Notes: Refer to Appendix S2 for references used in this table. Abbreviations: BTNR = Bukit Timah Nature Reserve, EA = Extant, EX = Extirpated, NLEA = Not listed but recorded in previous checklist and considered extant, NLEX = Not listed but recorded in previous checklist and considered extirpated, NR = Not recorded. C&P, 1956 = Corbet & Pendlebury, 1956 (see References), C&P 1992 = Corbet & Pendlebury, 1992 (see References).

*Last sightings were updated as of December 2015 based on sighting records compiled by the authors, relevant references have been cited. For discoveries made in 2016 & 2017, the last year of sighting was updated as of December 2017. See Appendix S2 for web-links of references cited in the checklist.

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
Family: Papilionidae, Subfamily: Papilioninae										
1	*Troides helena cerberus*	Common birdwing	Resident	2015	EA	EA	EA	EA	EA	
2	*Troides amphrysus ruficollis*	Malayan birdwing	Vagrant	2014	EA	EX	EX	EX	EA	Sightings in 2011, 2013 & 2014 (BC, 2014a)
3	*Pachliopta aristolochiae asteris*	Common rose	Resident	2015	EA	EA	EA	EA	EA	Individuals with totally black hindwings have also been sighted in 1995 and since 2007 but it is unclear if those are *Pachliopta antiphus* or an aberration (NSS, 2007; BC, 2011a).
4	*Chilasa clytia clytia*	Common mime	Resident	2015	EA	EA	EA	EA	EA	
5	*Chilasa paradoxa aenigma*	Great Blue mime	EX	–	EX	EX	EX	EX	EA	
6	*Papilio demoleus malayanus*	Lime butterfly	Resident	2015	EA	EA	EA	EA	EA	
7	*Papilio demolion demolion*	Banded swallowtail	Resident	2015	EA	EA	EA	EA	EA	
8	*Papilio iswara iswara*	Great helen	Resident	2015	EA	EA	EA	EA	EA	
9	*Papilio polytes romulus*	Common mormon	Resident	2015	EA	EA	EA	EA	EA	
10	*Papilio memnon agenor*	Great mormon	Resident	2015	EA	EA	EA	EA	EA	
11	*Papilio prexaspes prexaspes*	Blue helen	Resident	2015	EA	EA	EA	EA	NR	
12	*Papilio helenus helenus*	Red helen	Vagrant	2014	EA	NR	NR	NR	NR	First & only sighting from Kent Ridge in 2014 (NSS, 2014b; Jain, 2015)
13	*Graphium sarpedon luctatius*	Common bluebottle	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
14	*Graphium eurypylus mecisteus*	Great jay	Vagrant	2014	EA	NR	NR	NR	NR	First & only sighting in 2014 (BC, 2014d)
15	*Graphium evemon eventus*	Lesser or blue jay	Resident	2015	EA	EA	EA	EA	EA	
16	*Graphium doson evemonides*	Common jay	Resident	2015	EA	EA	EA	NR	NR	From Pulau Ubin since 2005 (BC, 2011b)
17	*Graphium bathycles bathycloides*	Striped jay	Vagrant	2014	EA	NR	NR	NR	NR	Two sightings so far: 1st in 2010; 2nd in 2014 (NSS, 2014c; Jain, 2015)
18	*Graphium agamemnon agamemnon*	Tailed jay	Resident	2015	EA	EA	EA	EA	EA	
19	*Pathysa antiphates itamputi*	Five bar swordtail	Resident	2015	EA	EA	EA	EA	EA	
20	*Lamproptera meges virescens*	Green dragontail	EX	–	EX	EX	EX	NLEX	EX	
Family: Pieridae, Subfamily: Pierinae										
21	*Prioneris philonome themana*	Red spot sawtooth	Vagrant	2014	EA	NR	NR	NR	NR	First & only sighting in 2014 (BC, 2014b)
22	*Delias singhapura singhapura*	Lion jezebel	EX	–	EX	EX	EX	EX	EA	
23	*Delias hyparete metarete*	Painted jezebel	Resident	2015	EA	EA	EA	EA	EA	
24	*Delias pasithoe parthenope*	Red base jezebel	Potentially extirpated	1991	EA	EA	EX	EA	EA	Last sighting (photo record) from Mandai in Mar 1991
25	*Leptosia nina malayana*	Psyche	Resident	2015	EA	EA	EA	EA	NR	
26	*Pieris canidia canidia*	Cabbage white	Resident	2015	EA	EA	EA	EA	EA	Non-native but recorded in Malay Peninsula since 1940s
27	*Cepora iudith malaya*	Orange gull	EX	–	EX	EX	EX	EX	EA	
28	*Appias lyncida vasava*	Chocolate albatross	Migrant	2015	EA	EA	EA	EA	EA	Regular seasonal sightings in past 5 years
29	*Appias libythea olferna*	Striped albatross	Resident	2015	EA	EA	EA	EA	EA	
30	*Appias nero figulina*	Orange albatross	EX	–	EX	EX	EX	EX	EA	
31	*Appias paulina distanti*	Lesser albatross	Vagrant	2014	EA	NR	NR	NR	NR	First & only sighting in 2014 (NSS, 2014a)

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
32	*Appias indra plana*	Plain puffin	Vagrant	2012	EA	NR	NR	NR	NR	First & only sighting in 2012 (BC, 2012a)
33	*Hebomoia glaucippe aturia*	Great orange tip	Vagrant	2004	EA	EA	EA	NR	NR	First & only sighting in 2004 (Richard Ong, pers. Comm.). New record for Singapore
34	*Pareronia valeria lutescens*	Wanderer	Migrant	2011	EA	EX	EX	EX	EA	Rediscovered from P. Ubin (BC, 2011c)
35	*Saletara liberia distanti*	Malaysian albatross	Vagrant	2014	EA	EX	EA	EX	EA	One sighting in 2014 (BC, 2014b)
Family: Pieridae, Subfamily: Coliadinae										
36	*Dercas verhuelli herodorus*	Tailed sulphur	EX	–	EX	EX	EX	EX	EA	
37	*Catopsilia pyranthe pyranthe*	Mottled emigrant	Resident	2015	EA	EA	EA	EA	EA	
38	*Catopsilia pomona pomona*	Lemon emigrant	Resident	2015	EA	EA	EA	EA	EA	
39	*Catopsilia scylla cornelia*	Orange emigrant	Resident	2015	EA	EA	EA	EA	EA	
40	*Eurema brigitta senna*	No brand grass yellow	Resident	2008	EA	EA	EX	EX	EA	Rediscovered in 2006 (BC, 2008a)
41	*Eurema hecabe contubernalis*	Common grass yellow	Resident	2015	EA	EA	EA	EA	EA	
42	*Eurema simulatrix tecmessa*	Hill grass yellow	Resident	2015	EA	EA	EA	EA	EA	
43	*Eurema blanda snelleni*	Three spot grass yellow	Resident	2015	EA	EA	EA	EA	EA	
44	*Eurema andersonii andersonii*	Anderson's grass yellow	Resident	2015	EA	EA	EA	EA	EA	
45	*Eurema lacteola lacteola*	Scarce grass yellow	EX	–	EX	EX	EX	NLEX	EX	
46	*Eurema ada iona*		EX	–	EX	EX	EX	EX	EA	
47	*Eurema sari sodalis*	Chocolate grass yellow	Resident	2015	EA	EA	EA	EA	EA	
48	*Gandaca harina distanti*	Tree yellow	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
				Family: Nymphalidae, Subfamily: Danainae						
49	*Danaus chrysippus chrysippus*	Plain tiger	Resident	2015	EA	EA	EA	EA	EA	
50	*Danaus genutia genutia*	Common tiger	Resident	2015	EA	EA	EA	EA	EA	
51	*Danaus melanippus hegesippus*	Black veined tiger	Resident	2015	EA	EA	EA	EA	EA	
52	*Parantica agleoides agleoides*	Dark gassy tiger	Resident	2015	EA	EA	EA	EA	EA	
53	*Parantica aspasia aspasia*	Yellow glassy tiger	Migrant	2014	EA	EA	EX	EX	EA	Sporadic sightings since year 2008 at Alexandra, Hort Park, P. Ubin. 2014 sighting from Gardens by the Bay (NSS, 2008; BC, 2014c)
54	*Parantica melaneus sinopion*	Chocolate tiger	EX	–	EX	EX	EX	NLEX	EX	
55	*Tirumala septentrionis septentrionis*	Dark blue tiger	Migrant	2016	NR	NR	NR	NR	NR	Multiple sightings. Photograhic evidence in 2016 (BC, 2016)
56	*Tirumala limniace*	Blue tiger	Vagrant	2016	NR	NR	NR	NR	NR	Single sighting in Varsity Park garden in 2016 (Gan, 2016)
57	*Ideopsis vulgaris macrina*	Blue glassy tiger	Resident	2015	EA	EA	EA	EA	EA	
58	*Ideopsis juventa sitah*	Grey glassy tiger	Vagrant	2015	EA	NR	NR	NR	NR	Two sightings from Ubin in 2014; Botanic Gardens in 2015 (BC, 2015a)
59	*Ideopsis gaura perakana*	Smaller wood nymph	EX	–	EX	EX	EX	EX	EA	
60	*Idea stolli logani*	Common tree nymph	Resident	2015	EA	EA	EA	EA	EA	
61	*Idea leuconoe chersonesia*	Mangrove tree nymph	Resident	2014	EA	EA	EA	EX	EA	One sighting from P. Ubin in 2014 but yearly records from P. Tekong (BC, 2014a)
62	*Euploea crameri bremeri*	Spotted black crow	Resident	2015	EA	EA	EA	EA	EA	
63	*Euploea camaralzeman malayica*	Malayan crow	Resident	2012	EA	EA	EA	EA	EA	
64	*Euploea eyndhovii gardineri*	Striped black crow	Resident	2015	EA	EA	EA	EA	EA	
65	*Euploea sylvester harrisii*	Double branded crow	EX	–	EX	EX	EA	NLEX	EX	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
66	*Euploea mulciber mulciber*	Striped blue crow	Resident	2015	EA	EA	EA	EA	EA	
67	*Euploea phaenareta castelnaui*	King crow	Resident	2015	EA	EA	EA	EA	EA	
68	*Euploea midamus singapura*	Blue spotted crow	Resident	2015	EA	EA	EA	EA	EA	
69	*Euploea tulliolus ledereri*	Dwarf crow	Resident	2015	EA	EA	EA	EX	EA	Rediscovered from P. Ubin in 2002 and then from Sime forest & BTNR (NSS, 2002a)
70	*Euploea eunice leucogonis*	Blue-branded king crow	EX	–	EX	EX	EX	EX	EA	
71	*Euploea radamanthus radamanthus*	Magpie crow	Resident	2015	EA	EA	EA	EA	EA	
Family: Nymphalidae, Subfamily: Satyrinae										
72	*Melanitis leda leda*	Common evening brown	Resident	2015	EA	EA	EA	EA	EA	
73	*Melanitis phedima abdullae*	Dark evening brown	EX	–	EX	EX	EX	NLEX	EX	
74	*Elymnias panthera panthera*	Tawny palmfly	Resident	2015	EA	EA	EA	EA	EA	
75	*Elymnias hypermnestra agina*	Common palmfly	Resident	2015	EA	EA	EA	EA	EA	
76	*Elymnias nesaea lioneli*	Tiger palmfly	EX	–	EX	EX	NLEX	NLEX	EX	
77	*Elymnias esaca esaca*		EX	–	EX	EX	EX	EX	EA	
78	*Elymnias penanga penanga*	Pointed palmfly	Potentially extirpated	1990s	EA	EA	EA	EA	EA	Very rare. Only from P. Ubin.
79	*Lethe europa malaya*	Bamboo tree brown	Resident	2015	EA	EA	EA	EA	EA	
80	*Xanthotaenia busiris busiris*	Yellow barred	EX	–	EX	EX	NLEX	NLEX	EX	
81	*Mycalesis fusca fusca*	Malayan bush brown	Resident	2015	EA	EA	EA	EA	EA	
82	*Mycalesis perseus cepheus*	Dingy bush brown	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
83	*Mycalesis perseoides perseoides*	Burmese bush brown	Resident	2015	EA	EA	EA	EA	NR	
84	*Mycalesis mineus macromalayana*	Dark brand bush brown	Resident	2015	EA	EA	EA	EA	EA	
85	*Mycalesis visala phamis*	Long brand bush brown	Resident	2015	EA	EA	EA	EA	EA	
86	*Mycalesis orseis nautilus*	Purple bush brown	Resident	2015	EA	EA	EA	EA	EA	
87	*Orsotriaena medus cinerea*	Smooth eyed bush brown (dark grass brown)	Resident	2015	EA	EA	EA	EA	EA	
88	*Coelites epiminthia epiminthia*		EX	–	EX	EX	NLEX	NLEX	EX	
89	*Ypthima huebneri*	Common four ring	Resident	2015	EA	EA	EA	EA	EA	
90	*Ypthima fasciata torone*	Scarce six ring	Potentially extirpated	2004	EA	EA	EA	EA	EA	Rediscovered in 1998 at Night Safari, Mandai. Last sighting in 2004 from MacRitchie
91	*Ypthima baldus newboldi*	Common five ring	Resident	2015	EA	EA	EA	EA	EA	
92	*Ypthima horsfieldii humei*	Malayan five ring	Resident	2015	EA	EA	EA	EA	NR	
93	*Ypthima pandocus corticaria*	Common three ring	Resident	2015	EA	EA	EA	EA	EA	
94	*Faunis canens arcesilas*	Common faun	Resident	2015	EA	EA	EA	EA	EA	
95	*Melanocyma faunula faunula*		EX	–	EX	EX	EX	NLEX	EX	
96	*Taenaris horsfieldii birchi*		EX	–	EX	EX	EX	NLEX	EX	
97	*Amathusia phidippus phidippus*	Palm king	Resident	2015	EA	EA	EA	EA	EA	
98	*Zeuxidia amethystus amethystus*	Saturn	Resident	2015	EA	EA	EA	EA	EA	
99	*Zeuxidia doubledayi doubledayi*		EX	–	EX	EX	EX	EX	EA	
100	*Thaumantis klugius lucipor*	Dark blue jungle glory	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
101	*Thaumantis noureddin noureddin*	Dark jungle glory	Vagrant	2016	EX	EX	EX	EX	EA	See NIE (2016), Chong (2016)
102	*Discophora sondaica despoliata*	Common duffer	Resident	2015	EA	EA	EA	EA	EA	
103	*Discophora timora perakensis*	Great duffer	EX	–	EX	EX	NLEX	EX	NR	Recorded by Fleming (1991) prior to 1975
Family: Nymphalidae, Subfamily: Heliconiinae										
104	*Acraea terpsicore*	Tawny coster	Resident	2015	EA	EA	NR	NR	NR	Non-native. Established since 2006 (BC, 2008d). Formerly known as Acraea violae - see Kirton, 2014
105	*Cethosia hypsea hypsina*	Malay lacewing	Resident	2015	EA	EA	EA	EA	EA	
106	*Cethosia methypsea*	Plain lacewing	Resident	2015	EA	EA	EA	EA	NR	Previously very rare but regular sightings from U. Seletar since 2014. Previously known as Cethosia penthesilea methypsea
107	*Cethosia cyane*	Leopard lacewing	Resident	2015	EA	EA	NLEA	NR	NR	Non-native but established since 2005 (BC, 2012d)
108	*Phalanta phalantha phalantha*	Leopard	Resident	2015	EA	EA	EA	EA	EA	
109	*Vagrans sinha sinha*	Vagrant	Vagrant	2014	EA	EX	EX	EX	EA	Sighting from Gardens by the Bay in 2013 and from Seletar area in 2014 (BC, 2013b; Jain, 2015)
110	*Cupha erymanthis lotis*	Rustic	Resident	2015	EA	EA	EA	EA	EA	
111	*Cirrochroa orissa orissa*	Banded yeoman	Resident	2015	EA	EA	EA	EA	EA	
112	*Cirrochroa emalea emalea*	Malay yeoman	Resident	2014	EA	EX	NLEX	NLEX	EX	Multiple sightings since 2013 in BTNR and Rifle range area (Jain, 2015)
113	*Cirrochroa tyche rotundata*	Common yeoman	Resident	2015	EA	NR	NR	NR	NR	Colony reported from an urban park since 2015 (BC, 2015b); New record for Singapore
114	*Vindula dejone erotella*	Cruiser	Resident	2015	EA	EA	EA	EA	EA	
115	*Terinos terpander robertsia*	Royal assyrian	Resident	2015	EA	EA	EA	EA	EA	
116	*Terinos atlita teuthras*		EX	–	EX	EX	NLEX	NLEX	EX	
				Family: Nymphalidae, Subfamily: Biblidinae						
117	*Ariadne ariadne ariadne*	Angled castor	Vagrant	2013	EA	EX	EX	EX	EA	One sighting in 2013 (BC, 2013a)
118	*Ariadne isaeus isaeus*		EX	–	EX	EX	NLEX	NLEX	EX	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
119	*Laringa castelnaui castelnaui*		EX	–	EX	EX	NLEX	NLEX	EX	
Family: Nymphalidae, Subfamily: Nymphalinae										
120	*Vanessa cardui*	Painted lady	Migrant	2015	EA	EA	NR	NR	NR	Recorded since 2007 (4 sightings). Last sighting at Pasir Panjang area (BC, 2007a; Chan S.K.M. pers. comm., 2015)
121	*Vanessa indica indica*	Indian red admiral	Vagrant	2013–2014	EA	EA	NR	NR	NR	Recorded since 2008 (two sightings; BC, 2008b)
122	*Symbrenthia hippoclus selangorana*	Malayan jester	Vagrant	2012	EA	NR	NR	NR	NR	New record (2 sightings; BC, 2012e)
123	*Hypolimnas anomala anomala*	Malayan eggfly	Resident	2015	EA	EA	EA	EA	EA	
124	*Hypolimnas misippus misippus*	Danaid eggfly	Resident	2009	EA	EA	EX	EA	NR	Rediscovered in 2009 but continues to be very rare. 4 – 5 sightings (only males); see ref. BC, 2009a
125a	*Hypolimnas bolina bolina*	Great eggfly	Resident	2015	EA	EA	EA	EA	EA	
125b	*Hypolimnas bolina jacintha*	Jacintha eggfly	Resident	2015	EA	EA	EA	NR	NR	
126a	*Doleschallia bisaltide ?bisaltide var.*	Autumn leaf	Resident	2015	EA	EA	EA	NR	NR	Subspecies discovered in 1999 (NSS, 1999; Eliot, 2006)
126b	*Doleschallia bisaltide pratipa*	Autumn leaf	Resident	2007	EA	EA	NLEA	NLEX	EX	Native subspecies. Last sighting in 2007 – bred from egg from Mandai area (SC, 2009)
127	*Rhinopalpa polynice eudoxia*	The wizard	EX	–	EX	EX	EX	NLEX	EX	
128	*Junonia hedonia ida*	Chocolate pansy	Resident	2015	EA	EA	EA	EA	EA	
129	*Junonia atlites atlites*	Grey pansy	Resident	2015	EA	EA	EA	EA	EA	
130	*Junonia almana javana*	Peacock pansy	Resident	2015	EA	EA	EA	EA	EA	
131	*Junonia orithya wallacei*	Blue pansy	Resident	2015	EA	EA	EA	EA	EA	
132	*Kallima limborgii amplirufa*	Leaf butterfly	EX	–	EX	EX	EX	NLEX	EX	
Family: Nymphalidae, Subfamily: Cyrestinae										
133	*Chersonesia rahria rahria*	Wavy maplet	EX	–	EX	EX	EX	EX	EA	
134	*Chersonesia peraka peraka*	Little maplet	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
Family: Nymphalidae, Subfamily: Limenitidinae										
135	*Moduza procris milonia*	Commander	Resident	2015	EA	EA	EA	EA	EA	
136a	*Lebadea martha parkeri*	Knight	Resident	2015	EA	EA	EA	EA	EA	Native sub-species; now hybridises with *L. m. malayana*
136b	*Lebadea martha malayana*	Knight	Resident	2015	EA	EA	EA	NR	NR	Recorded since 2005; now hybridises with *L. m. parkeri.*
137	*Athyma pravara helma*	Lance sergeant	Resident	2015	EA	EA	EA	EA	NR	
138	*Athyma asura idita*	Studded sergeant	Resident	2015	EA	EA	EA	EA	EA	
139	*Athyma kanwa kanwa*	Dot-dash sergeant	Resident	2015	EA	EA	EA	EA	EA	
140	*Athyma reta moorei*	Malay staff sergeant	Resident	2015	EA	EA	EA	EA	EA	
141	*Athyma nefte subrata*	Colour sergeant	Resident	2015	EA	EA	EA	EA	EA	
142	*Athyma perius perius*	Common sergeant	EX	–	EX	EX	EX	EX	EA	
143	*Pandita sinope sinope*	Colonel	Resident	2015	EA	EA	EA	EA	EA	
144	*Neptis hylas papaja*	Common sailor	Resident	2015	EA	EA	EA	EA	EA	
145	*Neptis leucoporos cresina*	Burmese (grey) sailor	Resident	2015	EA	EA	EA	EA	EA	
146	*Neptis omeroda omeroda*		EX	–	EX	EX	NLEX	NLEX	EX	
147	*Neptis harita harita*	Chocolate sailor	Resident	2015	EA	EA	EA	EA	NR	
148	*Neptis miah batara*	Small yellow sailor	EX	–	EX	EX	EX	EX	EA	
149	*Phaedyma columella singa*	Short banded sailor	Resident	2015	EA	EA	EA	EA	EA	
150	*Lasippa heliodore dorelia*	Burmese lascar	Resident	2015	EA	EA	EA	EA	EA	
151	*Lasippa tiga siaka*	Malayan lascar	Resident	2015	EA	EA	EA	EA	NR	
152	*Pantoporia hordonia hordonia*	Common lascar	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
153	*Pantoporia paraka paraka*	Perak lascar	Resident	2015	EA	EA	EA	EA	EA	
154	*Pantaporia sandaka sandaka*		EX	–	EX	EX	EX	EX	NR	
155	*Pantoporia dindinga*		EX	–	EX	EX	EX	EX	EA	
156	*Pantoporia aurelia aurelia*		EX	–	EX	EX	EX	EX	EA	
157	*Parthenos sylvia lilacinus*	Clipper	Vagrant	2013	EX	EX	EX	EX	EA	One sighting in 2013 though there was no photographic evidence (Tea Y. K., pers. Comm.; Jain, 2014)
158	*Tanaecia pelea pelea*	Malay viscount	Resident	2015	EA	EA	EA	EA	EA	
159	*Tanaecia iapis puseda*	Horsfield's baron	Resident	2015	EA	EA	EA	EA	EA	
160	*Tanaecia godartii puloa*	Malay count	EX	–	EX	EX	EX	EX	NR	
161	*Tanaecia clathrata violaria*		EX	–	EX	EX	NLEX	NLEX	EX	
162	*Euthalia monina monina*	Malay baron	Resident	2015	EA	EA	EA	EA	EA	
163	*Euthalia merta merta*	White tipped baron	Resident	2014	EA	EA	EA	EX	EA	See ref. Jain, 2015
164	*Euthalia aconthea gurda*	Baron	Resident	2015	EA	EA	EA	EA	EA	
165	*Euthalia adonia pinwilli*	Green baron	Resident	2015	EA	EA	EA	EA	EA	
166	*Euthalia djata rubidifascia*		EX	–	EX	EX	EX	EX	NR	
167	*Dophla evelina compta*		EX	–	EX	EX	EX	EX	EA	
168	*Bassarona teuta goodrichi*		EX	–	EX	EX	NLEX	EX	NR	
169	*Lexias dirtea merguia*	Dark (black tipped) archduke	Resident	2015	EA	EA	EA	EA	NR	
170	*Lexias pardalis dirteana*	Archduke	Resident	2015	EA	EA	EA	EA	EA	
171	*Lexias canescens pardalina*	Yellow archduke	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
Family: Nymphalidae, Subfamily: Aparturinae										
172	*Eulaceura osteria kumana*	Purple duke (elegant emperor)	Resident	2015	EA	EA	EA	EA	EA	
173	*Euripus nyctelius euploeoides*	Courtesan	Resident	2013	EA	EA	EA	EA	EA	See ref. Jain, 2014
Family: Nymphalidae, Subfamily: Charaxinae										
174	*Prothoe franck uniformis*	Blue begum	EX	–	EX	EX	EX	EX	EA	
175	*Charaxes bernardus crepax*	Tawny rajah	EX	–	EX	EX	EX	EX	EA	
176	*Charaxes solon echo*	Black rajah	Resident	2013	EA	EA	EA	NLEX	EX	Rediscovery from Upper Pierce area in 2002 (NSS, 2002b). V. rare. Last sighting from BTNR (Jain, 2014)
177	*Polyura hebe plautus*	Plain nawab	Resident	2015	EA	EA	EA	EA	EA	
178	*Polyura schreiber tisamenus*	Blue nawab	Resident	2015	EA	EA	EA	EA	EA	
179	*Polyura moori moori*	Malayan nawab	Vagrant	2014	EX	EX	EX	EX	EX	Sighted from P. Ubin in 2012 & 2014 (NSS, 2012; Jain, 2015)
180	*Polyura athamas athamas*	Common nawab	EX	–	EX	EX	NLEX	NLEX	EX	
Family: Riodinidae, Subfamily: Riodininae										
181	*Zemeros flegyas albipunctatus*	Punchinello	EX	–	EX	EX	EX	EX	EA	
182	*Zemeros emesoides emesoides*		EX	–	EX	EX	NLEX	NLEX	EX	
183	*Abisara geza niya*	Spotted judy	Resident	2015	EA	EA	EA	EA	EA	
184	*Abisara savitri savitri*	Malay tailed judy	Resident	2015	EA	EA	EA	EA	EA	
185	*Abisara saturata kausambioides*	Malayan plum judy	Resident	2015	EA	EA	EA	EX	EA	
186	*Laxita thuisto thuisto*	Lesser harlequin	Resident	2015	EA	EA	EA	EA	EA	
187	*Taxila haquinus haquinus*	The harlequin	Resident	2015	EA	EA	EA	EX	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
Family: Lycaenidae, Subfamily: Poritiinae										
188	*Poritia philota philota*	Malay gem	Resident	2008	EA	EA	EA	EA	EA	
189	*Poritia sumatrae sumatrae*	Sumatran gem	Resident	2015	EA	EA	EA	EA	EA	
190	*Poritia erycinoides phraatica*		EX	–	EX	EX	EX	NLEX	EX	
191	*Poritia pleurata*		EX	–	EX	EX	NLEX	NLEX	EX	
192	*Simiskina phalena phalena*		EX	–	EX	EX	NLEX	NLEX	EX	
193	*Simiskina pheretia pheretia*		EX	–	EX	EX	NLEX	NLEX	EX	
194	*Simiskina pediada*		EX	–	EX	EX	EX	NLEX	EX	
195	*Simiskina phalia potina*	Blue brilliant	EX	–	EX	EX	EX	EX	EX	
196	*Deramas livens livens*		EX	–	EX	EX	NLEX	NLEX	EX	
Family: Lycaenidae, Subfamily: Miletinae										
197	*Miletus gaesa gaesa*		EX	–	EX	EX	EX	EX	EA	
198	*Miletus gopara gopara*	Round-band browning	Potentially extirpated	1998	EA	EA	EA	EA	EA	Last sighting from Chestnut forest
199	*Miletus biggsii biggsii*	Bigg's browning	Resident	2015	EA	EA	EA	EA	EA	
200	*Miletus symethus petronius*	Blue or great browning	Resident	2015	EA	EA	EA	EA	EA	
201	*Allotinus unicolor unicolor*	Lesser darkwing	Resident	2015	EA	EA	EA	EA	EA	
202	*Allotinus davidis*		EX	–	EX	EX	EX	EX	NR	
203	*Allotinus strigatus malayanus*		EX	–	EX	EX	EX	EX	EA	
204	*Allotinus subviolaceus subviolaceus*		EX	–	EX	EX	EX	EX	EA	
205	*Allotinus substrigosus substrigosus*		EX	–	EX	EX	EX	EX	EA	
206	*Allotinus horsfieldi permagnus*		EX	–	EX	EX	EX	EX	EA	
207	*Allotinus leogoron leogoron*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
208	*Allotinus corbeti*		EX	–	EX	EX	EX	NLEX	NR	
209	*Logania marmorata damis*	Common mottle	Resident	2015	EA	EA	EA	EA	EA	
210	*Spalgis epius epius*	The apefly	Resident	2015	EA	EA	EA	EA	EA	
211	*Taraka mahanetra*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
212	*Liphyra brassolis abbreviata*	Moth butterfly	Resident	2009	EA	EA	EX	EX	EA	Rediscovery in 2009 (BC, 2009b). Very rare
Family: Lycaenidae, Subfamily: Aphnaeinae										
213	*Spindasis syama terana*	Club/black banded silverline	Resident	2015	EA	EA	EA	EA	EA	
214	*Spindasis lohita senama*	Long banded silverline	Resident	2015	EA	EA	EA	EA	EA	
Family: Lycaenidae, Subfamily: Curetinae										
215	*Curetis bulis stigmata*		EX	–	EX	EX	EX	EX	EA	
216	*Curetis sperthis sperthis*		EX	–	EX	EX	EX	EX	EA	
217	*Curetis tagalica jopa*		EX	–	EX	EX	NLEX	NLEX	EX	
218	*Curetis regula*		EX	–	EX	EX	EX	EX	EX	Thought extirpated by C&P (1956) but later recorded by C&P (1992)
219	*Curetis santana malayica*	Malayan sunbeam	Resident	2015	EA	EA	EA	EA	EA	
220	*Curetis saronis sumatrana*	Sumatran sunbeam	Resident	2015	EA	EA	EA	EA	EA	
Family: Lycaenidae, Subfamily: Polyommatinae										
221	*Castalius rosimon rosimon*	Common pierrot	Potentially extirpated	1990s	EA	EA	EX	EA	NR	Reported from single specimen in Mandai in early 1990s
222	*Caleta elna elvira*	Elbowed pierrot	Resident	2015	EA	EA	EA	EA	EA	
223	*Everes lacturnus rileyi*	Indian cupid	Resident	2014	EA	EA	EA	EA	EA	See ref. Jain, 2015
224	*Lycaenopsis haraldus haraldus*		EX	–	EX	EX	NLEX	NLEX	EX	

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225	*Neopithecops zalmora zalmora*	The quaker	Resident	2015	EA	EA	EA	EA	EA	
226	*Megisba malaya sikkima*	The Malayan	Resident	2015	EA	EA	EA	EA	NR	
227	*Acytolepis puspa lambi*	Common hedge blue	Resident	2015	EA	EA	EA	EA	EA	
228	*Zizina otis lampa*	Lesser grass blue	Resident	2015	EA	EA	EA	EA	EA	
229	*Zizula hylax pygmaea*	Pygmy grass blue	Resident	2015	EA	EA	EA	EA	EA	
230	*Zizeeria maha serica*	Pale grass blue	Resident	2015	EA	EA	EA	NR	NR	Non-native and discovered by S. Neo in 2001 (NSS, 2001)
231	*Zizeeria karsandra*	Dark grass blue	EX	–	EX	EX	EX	EX	EA	
232	*Chilades pandava pandava*	Cycad blue	Resident	2015	EA	EA	EA	EA	EA	
233	*Euchrysops cnejus cnejus*	Gram blue	Resident	2015	EA	EA	EA	EA	EA	
234	*Catochrysops strabo strabo*	Forget-me-not	Resident	2014	EA	EA	EA	EA	EA	See ref. Jain, 2014
235	*Catochrysops panormus exiguus*	Silver forget-Mm-not	Resident	2015	EA	EA	EA	EA	EX	Reported as new record by Khew & Neo (1997) but actually a rediscovery
236	*Lampides boeticus*	Pea blue	Resident	2015	EA	EA	EA	EA	EA	
237	*Jamides bochus nabonassar*	Dark caerulean	Resident	2015	EA	EA	EA	EA	EA	
238	*Jamides alecto ageladas*	Metallic caerulean	Resident	2015	EA	EA	EA	EX	EA	Rediscovered in 2008 (BC, 2009c)
239	*Jamides celeno aelianus*	Common caerulean	Resident	2015	EA	EA	EA	EA	EA	
240	*Jamides malaccanus malaccanus*	Malaccan caerulean	Resident	2013	EA	EA	EA	NR	NR	See ref. Jain, 2014
241	*Jamides caeruleus caeruleus*	Sky blue	Resident	2014	EA	EA	EA	EA	EA	See ref. Jain, 2015
242	*Jamides elpis pseudelpis*	Glistening caerulean	Resident	2013	EA	EA	EA	EX	EA	Rediscovered in 2009 (BC, 2009d), see ref. Jain, 2014
243	*Jamides pura pura*		EX	–	EX	EX	EX	EX	EA	
244	*Jamides philatus subditus*		EX	–	EX	EX	EX	EX	NR	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
245	*Jamides abdul abdul*		EX	–	EX	EX	EX	EX	EA	
246	*Nacaduba pendleburyi pendleburyi*		EX	–	EX	EX	EX	EX	EA	
247	*Nacaduba hermus swatipa*		EX	–	EX	EX	EX	EX	EA	
248	*Nacaduba subperusia lysa*		EX	–	EX	EX	EX	EX	EA	
249	*Nacaduba russelli*		EX	–	EX	EX	EX	EX	NR	
250	*Nacaduba angusta kerriana*	White fourline blue	Resident	2008	EA	EA	EX	EX	EA	Rediscovered in 2008 (BC, 2009c)
251	*Nacaduba sanaya elioti*	Jewel fourline blue	Resident	2015	EA	EA	EX	EX	EA	Rediscovered in 2008 (BC, 2008f)
252	*Nacaduba pactolus odon*	Large fourline blue	Resident	2014	EA	EA	EX	EX	EA	Rediscovered in 2009 (BC, 2009d), see ref. Jain, 2015
253	*Nacaduba kurava nemana*	Transparent six-line blue	Resident	2014	EA	EX	EX	EX	EA	Rediscovered; see ref. Jain, 2015
254	*Nacaduba pavana singapura*	Singapore fourline blue	Resident	2014	EA	EA	EX	EX	EA	Rediscovered in 2010 (BC, 2011e); see ref. Jain, 2015
255	*Nacaduba beroe neon*	Opaque six-line blue	Resident	2015	EA	EA	EA	EA	EA	
256	*Nacaduba berenice icena*	Rounded six-line blue	Resident	2015	EA	EA	EA	EA	EA	
257	*Nacaduba calauria malayica*	Malayan dark six-line blue	Resident	2015	EA	EA	EA	EX	EA	Missed by early authors
258	*Nacaduba biocellata*	Two spotted line blue	Resident	2013	EA	EA	EA	NR	NR	Non-native. Possible introduction from Australia with plants. Sighted since 2004 (BC, 2008g), see ref. Jain, 2014
259	*Ionolyce helicon merguiana*	Pointed line blue	Resident	2015	EA	EA	EA	EA	EA	
260	*Prosotas lutea sivoka*	Banded line blue	Resident	2013	EA	NR	NR	NR	NR	Breeding population discovered in 2012 (BC, 2012b). Regular sightings since; see ref. Jain, 2014
261	*Prosotas nora superdates*	Common line-blue	Resident	2015	EA	EA	EA	EA	EA	

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262	*Prosotas dubiosa lumpura*	Tailless line blue	Resident	2015	EA	EA	EA	EX	EA	Rediscovered in 2008.
263	*Prosotas aluta nanda*	Barred line blue	Resident	2012	EA	NR	NR	NR	NR	Recorded since 2008 but confirmed in 2014 (BC, 2014e); see ref. Jain, 2013
264	*Una usta usta*	Singleton	EX	–	EX	EX	EX	EX	EA	
265	*Catopyrops ancyra*	Ancyra blue	Resident	2015	EA	EA	EA	NR	NR	Forest species. Missed by early authors. Sighted since 2004 - see BC, 2008c
266	*Petrelaea dana dana*	Dingy line blue	Resident	2015	EA	EA	EA	NR	NR	First discovery in 2005 from Central Ubin (Soon Chye, pers. comm.)
267	*Anthene emolus goberus*	Ciliate blue	Resident	2015	EA	EA	EA	EA	EA	
268	*Anthene lycaenina miya*	Pointed ciliate blue	Resident	2015	EA	EA	EA	EA	EA	
Family: Lycaenidae, Subfamily: Theclinae										
269	*Arhopala lurida*		EX	–	EX	EX	EX	EX	NR	
270	*Arhopala allata pandora*		EX	–	EX	EX	EX	EX	EA	
271	*Arhopala delta*		EX	–	EX	EX	EX	EX	NR	
272	*Arhopala avathina avathina*		EX	–	EX	EX	EX	EX	EA	
273	*Arhopala muta maranda*	Mutal oakblue	Resident	2012–2014	EA	EX	EX	EX	EA	Rediscovered since 2010 (BC, 2015d)
274	*Arhopala kurzi*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
275	*Arhopala aroa aroa*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
276	*Arhopala zambra zambra*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
277	*Arhopala vihara vihara*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
278	*Arhopala moorei busa*		EX	–	EX	EX	EX	EX	EA	
279	*Arhopala metamuta metamuta*		EX	–	EX	EX	EX	EX	EA	
280	*Arhopala inornata inornata*		EX	–	EX	EX	EX	EX	EA	
281	*Arhopala democritus lycaenaria*		EX	–	EX	EX	EX	EX	EA	
282	*Arhopala alitaeus pardenas*	Purple broken-band oakblue	Resident	2012	EA	EX	EX	EX	EA	Rediscovered. Bred in 2011 (see BC, 2015c); see ref. Jain, 2013

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
283	*Arhopala agrata agrata*	de Niceville's dull oakblue	EX	–	EX	EX	EX	EX	EA	
284	*Arhopala milleri*		EX	–	EX	EX	EX	EX	EA	
285	*Arhopala phanda phanda*		EX	–	EX	EX	EX	EX	EA	
286	*Arhopala normani*		EX	–	EX	EX	EX	EX	NR	
287	*Arhopala barami penanga*		EX	–	EX	EX	EX	EX	EA	
288	*Arhopala agelastus agelastus*		EX	–	EX	EX	NLEX	NLEX	EX	
289	*Arhopala wildeyana wildeyana*		EX	–	EX	EX	EX	EX	EA	
290	*Arhopala hypomuta hypomuta*		EX	–	EX	EX	EX	EX	EA	
291	*Arhopala corinda acestes*		EX	–	EX	EX	EX	EX	EA	
292	*Arhopala ariel*		EX	–	EX	EX	EX	EX	EA	
293	*Arhopala achelous achelous*		EX	–	EX	EX	EX	EX	EA	
294	*Arhopala fulla intaca*		EX	–	EX	EX	EX	EX	EA	
295	*Arhopala centaurus nakula*	Centaur oakblue	Resident	2015	EA	EA	EA	EA	EA	
296	*Arhopala myrzala lammas*	Malayan oakblue	Resident	2015	EA	EA	EA	EA	EA	
297	*Arhopala aedias agnis*	Large metallic oakblue	Resident	2015	EA	EA	EA	EA	EA	Horace Tan, pers. comm.
298	*Arhopala atosia malayana*	Tailed disc oakblue	Resident	2014	EA	EA	EA	EA	EA	
299	*Arhopala epimuta epiala*	Common disc oakblue	Resident	2013	EA	EA	EA	EA	EA	See ref. Jain, 2014
300	*Arhopala amphimuta amphimuta*	Broad yellow oakblue	Resident	2013	EA	EA	EX	EA	EA	Rediscovered and bred since 2011 (see BC, 2011d); see ref. Jain, 2014
301	*Arhopala major major*	Major yellow oakblue	Resident	2015	EA	EA	EA	EA	NR	
302	*Arhopala antimuta antimuta*	Small tailless oakblue	Resident	2013	EA	EA	EX	EA	EA	Rediscovered; see ref. Jain, 2014

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
303	*Arhopala pseudomuta pseudomuta*	Raffles' oakblue	Resident	2013	EA	EA	EX	EA	EA	Rediscovered; see ref. Jain, 2014
304	*Arhopala athada athada*	Vinous oakblue	Resident	2015	EA	EA	EA	EA	EA	
305	*Arhopala sublustris ridleyi*		Resident	2014	EX	EX	EX	EX	NR	Rediscovered; see ref. Jain, 2015
306	*Arhopala silhetensis adorea*	Sylhet oakblue	Resident	2012	EA	EA	EX	EX	EA	Rediscovered in 2008 (BC, 2008e); see ref. Jain, 2013
307	*Arhopala eumolphus maxwelli*	Green oakblue	Resident	2014	EA	EA	EX	EX	EA	Rediscovered in 2007 (BC, 2007b); see ref. Jain, 2015
308	*Arhopala aurea*	Golden green oakblue	Resident	2013	EA	EA	EA	EA	EA	See ref. Jain, 2014
309	*Arhopala trogon*	Green suffused oakblue	Resident	2015	EA	EA	EA	EA	EA	
310	*Arhopala ammon ammon*	Lesser Malayan oakblue	Resident	2014	EA	EA	EA	EA	EA	
311	*Arhopala abseus abseus*	Aberrant oakblue	Resident	2015	EA	EA	EA	EA	EA	
312	*Flos diardi capeta*	Bifid plushblue	Resident	2015	EA	EA	EA	EA	EA	
313	*Flos fulgida singhapura*	Shining plushblue	Resident	2015	EA	EA	EA	EA	EA	
314	*Flos anniella anniella*	Darky plushblue	Resident	2015	EA	EA	EA	EA	EA	
315	*Flos apidanus saturatus*	Plain plushblue	Resident	2015	EA	EA	EA	EA	EA	
316	*Semanga superba deliciosa*	The red edge	Resident	2015	EA	EA	EA	EA	EA	
317	*Surendra vivarna amisena*	Acacia blue	Resident	2015	EA	EA	EA	EA	EA	
318	*Surendra florimel*		EX	–	EX	EX	NLEX	NLEX	EX	
319	*Iraota timoleon wickii*		EX	–	EX	EX	EX	EX	EA	
320	*Iraota rochana boswelliana*	Scarce silverstreak	Resident	2015	EA	EA	EA	EA	EA	
321	*Iraota distanti distanti*	Spotted silverstreak	Potentially extirpated	1999	EA	EA	EA	EA	NR	Last sighting from Upper Pierce by Khew

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
322	*Catapaecilma major emas*	Gray tinsel	Resident	2012	EA	EA	EA	EX	EA	Rediscovered (BC, 2010b); see ref. Jain, 2013
323	*Loxura atymnus fuconius*	Yamfly	Resident	2015	EA	EA	EA	EA	EA	
324	*Eooxylides tharis distanti*	Branded imperial	Resident	2015	EA	EA	EA	EA	EA	
325	*Thamala marciana marciana*		EX	–	EX	EX	NLEX	NLEX	EX	
326	*Cheritra freja frigga*	Common imperial	Resident	2015	EA	EA	EA	EA	EA	
327	*Drupadia ravindra moorei*	Common posy	Resident	2015	EA	EA	EA	EA	EA	
328	*Drupadia rufotaenia rufotaenia*	Pygmy posy	Resident	2015	EA	EA	EA	EA	EA	
329	*Drupadia theda thesmia*	Dark posy	Resident	2015	EA	EA	EA	EA	EA	
330	*Drupadia scaeva scaeva*		EX	–	EX	EX	EX	NLEX	EX	
331	*Horaga albimacula albistigmata*	Brown onyx	EX	–	EX	EX	EX	EX	EA	
332	*Horaga chalcedonyx malaya*		EX	–	EX	EX	EX	EX	NR	
333	*Horaga onyx sardonyx*	Common onyx	EX	–	EX	EX	EX	EX	EA	
334	*Horaga syrinx maenala*	Ambon onyx	Resident	2015	EA	EA	EA	EA	EA	
335	*Dacalana vidura azyada*		EX	–	EX	EX	NLEX	NLEX	EX	
336	*Pratapa deva relata*	White royal	Resident	2015	EA	EA	EA	EX	EA	Rediscovered and bred since 2008 (BC, 2008h)
337	*Pratapa icetoides calculis*		EX	–	EX	EX	EX	EX	EA	
338	*Tajuria cippus maxentius*	Peacock royal	Resident	2015	EA	EA	EA	EA	EA	
339	*Tajuria sunia*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
340	*Tajuria mantra mantra*	Felder's royal	Resident	2015	EA	EA	EA	EX	EA	Rediscovered in 1999 (Khew, 2015)
341	*Tajuria deudorix ingeni*		EX	–	EX	EX	EX	EX	EA	
342	*Tajuria dominus dominus*	Sovereign royal	Resident	2015	EA	EA	EA	EX	EA	Rediscovered in 2006 (Khew, 2015); Chloe Tan, pers. comm. 2015
343	*Rachana jalindra burbona*	Banded royal	Resident	2014	EA	EA	EA	EX	EA	Rediscovered in 2006 (Khew, 2015); see ref. Jain, 2015
344	*Purlisa gigantea gigantea*		EX	–	EX	EX	EX	EX	EA	
345	*Jacoona anasuja anasuja*	Great imperial	Resident	2015	EA	EA	EA	EA	EA	

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346	*Neocheritra amrita amrita*	Grand imperial	Resident	2015	EA	EA	EA	EA	EA	
347	*Manto hypoleuca terana*	Green imperial	Resident	2015	EA	EA	EX	EX	EA	Rediscovered in 2008 (BC, 2008f)
348	*Mantoides gama gama*		EX	–	EX	EX	EX	EX	EA	
349	*Remelana jangala travana*	Chocolate royal	Resident	2015	EA	EA	EA	EA	EA	
350	*Pseudotajuria donatana donatana*	Golden royal	Resident	2013	EA	EA	EA	EX	EA	Rediscovered in 2005 at Upper Pierce; see ref. Jain, 2014
351	*Ancema blanka blanka*	Silver royal	Resident	2015	EA	EA	EA	EX	NR	Rediscovered in 2005 at Telok Blangah Hill Park; Amy Tsang, pers. comm. 2015
352	*Hypolycaena thecloides thecloides*	Dark tit	Resident	2015	EA	EA	EA	EA	EA	
353	*Hypolycaena erylus teatus*	Common tit	Resident	2015	EA	EA	EA	EA	EA	
354	*Zeltus amasa maximinianus*	Fluffy tit	Resident	2015	EA	EA	EA	EA	EA	
355	*Deudorix epijarbas cinnabarus*	Cornelian	Resident	2015	EA	EA	EA	EA	EA	
356	*Deudorix elioti*	Eliot's cornelian	Resident	2015	EA	EA	EA	EX	NR	Rediscovered in 2003 (NSS, 2003)
357	*Deudorix staudingeri*	Large cornelian	Resident	2012	EX	EX	EX	EX	EA	Rediscovered in 2012 (SC, 2015a)
358	*Drina cowani*		EX	–	EX	EX	EX	EX	EA	
359	*Drina maneia*		EX	–	EX	EX	NLEX	NLEX	EX	
360	*Virachola subguttata malaya*		EX	–	EX	EX	EX	EX	EA	
361	*Virachola kessuma deliochus*	Pitcher blue	Resident	2012	EA	EA	EA	EA	EA	See ref. Jain, 2013
362	*Sinthusa nasaka amba*	Narrow spark	Resident	2015	EA	EA	EA	EA	NR	
363	*Bindahara phocides phocides*	The plane	Resident	2015	EA	EA	EA	EX	EA	Rediscovered species; see ref. Jain, 2015
364	*Bullis buto cowani*		EX	–	EX	EX	EX	EX	EA	
365	*Rapala abnormis abnormis*		EX	–	EX	EX	EX	EX	EA	
366	*Rapala damona*		EX	–	EX	EX	EX	EX	NR	
367	*Rapala cowani*		EX	–	EX	EX	EX	EX	EA	
368	*Rapala domitia domitia*	Yellow flash	Resident	2015	EA	EA	EA	EA	EA	
369	*Rapala suffusa barthema*	Suffused flash	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
370	*Rapala pheretima sequeira*	Copper flash	Resident	2015	EA	EA	EA	EX	EA	Rediscovered species
371	*Rapala dieneces dieneces*	Scarlet flash	Resident	2015	EA	EA	EA	EA	EA	
372	*Rapala iarbus iarbus*	Common red flash	Resident	2015	EA	EA	EA	EA	EA	
373	*Rapala manea chozeba*	Slate flash	Resident	2015	EA	EA	EA	EA	EA	
374	*Rapala varuna orseis*	Indigo flash	Resident	2015	EA	EA	EA	EA	EA	
375	*Araotes lapithis uruwela*		EX	–	EX	EX	EX	NLEX	EX	
376	*Sithon nedymond nedymond*	The plush	EX	–	EX	EX	NLEX	NLEX	EX	
Family: Hesperiidae, Subfamily: Coeliadinae										
377	*Bibasis etelka*	Great orange awlet	Resident	2015	EA	EA	EA	EA	EX	
378	*Bibasis harisa consobrina*	Orange awlet	Resident	2015	EA	EA	EA	EA	EA	
379	*Bibasis sena uniformis*	Orange-tail awl	Resident	2014	EA	EA	EA	NR	NR	New record in 2002; see ref. Jain, 2015
380	*Bibasis oedipodea*		EX	–	EX	EX	NLEX	NLEX	EX	
381	*Hasora chromus chromus*	Common banded awl	Resident	2015	EA	EA	EA	EA	EA	
382	*Hasora taminatus malayana*	White banded awl	Resident	2015	EA	EA	EA	EA	EA	
383	*Hasora schoenherr chuza*	Yellow banded awl	Resident	2015	EA	EA	EA	EA	EA	
384	*Hasora badra badra*	Common awl	Resident	2015	EA	EA	EA	EA	EA	See ref. Jain, 2015
385	*Hasora vitta vitta*	Plain banded awl	Resident	2015	EA	EA	EA	EA	EA	
386	*Hasora lizetta*		EX	–	EX	EX	EX	EX	EA	
387	*Badamia exclamationis*	Brown awl	Resident	2015	EA	EA	EA	EA	EA	
388	*Choaspes plateni caudatus*		EX	–	EX	EX	EX	NLEX	EX	
389	*Choaspes subcaudatus crawfurdi*		EX	–	EX	EX	EX	EX	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
Family: Hesperiidae, Subfamily: Pyrginae										
390	*Capila phanaeus ferrea*		EX	–	EX	EX	EX	NLEX	EX	
391	*Tapena thwaitesi bornea*	Black angle	Resident	2014	EA	EA	EA	EA	NR	See ref. Jain, 2015
392	*Odina hieroglyphica ortina*	Hieroglyphic flat	Resident	2015	EA	EA	EA	EA	EA	
393	*Celaenorrhinus asmara asmara*	White banded flat	Resident	2011	EA	EX	EX	EX	EA	Rediscovered in 2011 (BC, 2011f)
394	*Pseudocoladenia dan dhyana*	Fulvous pied flat	Resident	2014	EA	EA	EA	NR	NR	Discovered in 2002 (Chan K. M. Simon, pers. Comm.)
395	*Gerosis limax dirae*	Black and white flat	Potentially extirpated	2001	EA	EA	EA	EA	EA	Last sighting from BTNR (Gan CW, pers. comm.)
396	*Gerosis tristis*		Potentially extirpated	2004	EA	EA	EX	EX	NR	One sighting in 2004 (Sunny Chir, pers. comm.). Previously misidentified as G. sinica minima in Khew (2010)
397	*Gerosis phisara phisara*		Potentially extirpated	No recent sightings	EX	EX	EA	EA	NR	Potentially misidentified previously
398	*Tagiades japetus atticus*	Common snow flat	Resident	2015	EA	EA	EA	EA	EA	
399	*Tagiades gana gana*	Large snow flat	Resident	2015	EA	EA	EA	EA	EA	
400	*Tagiades ultra*	Ultra snow flat	Resident	2015	EA	EA	EA	EA	EX	Reported extirpated by C&P, 1992; entered by Khew & Neo, 1997 as new record, must be rediscovery instead
401	*Tagiades calligana*	Malayan snow flat	Resident	2014	EA	EA	EA	EA	EA	
402	*Mooreana trichoneura trichoneura*	Yellow flat	Resident	2015	EA	NR	NR	NR	NR	New discovery in 2012 (BC, 2012c). Regular sightings since
403	*Odontoptilum angulatum angulatum*	Chestnut angle	Resident	2015	EA	EA	EA	EA	EA	
Family: Hesperiidae, Subfamily: Hesperiinae										
404	*Ampittia dioscorides camertes*	Bush hopper	Resident	2015	EA	EA	EA	EA	EA	

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405	*Halpe insignis*		EX	–	EX	EX	EX	NLEX	EX	
406	*Halpe elana*		EX	–	EX	EX	EX	EX	NR	Recorded by Fleming (1991) prior to 1975
407	*Halpe ormenes vilasina*	Dark banded ace	Resident	2015	EA	EA	EA	EA	NR	
408	*Iambrix salsala salsala*	Chestnut bob	Resident	2015	EA	EA	EA	EA	EA	
409	*Iambrix stellifer*	Starry bob	Resident	2015	EA	EA	EA	EA	EA	
410	*Idmon distanti*		EX	–	EX	EX	EX	EX	EA	
411	*Idmon obliquans obliquans*		EX	–	EX	EX	EX	EX	EA	
412	*Psolos fuligo fuligo*		EX	–	EX	EX	EA	EX	EA	
413	*Astictopterus jama jama*	Forest hopper	Resident	2013	EA	EA	EX	EX	EA	Rediscovered; see ref. Jain, 2014
414	*Ancistroides nigrita maura*	Chocolate demon	Resident	2015	EA	EA	EA	EA	EA	
415	*Ancistroides gemmifer gemmifer*		EX	–	EX	EX	NLEX	NLEX	EX	
416	*Notocrypta paralysos varians*	Banded demon	Resident	2015	EA	EA	EA	EA	EA	
417	*Notocrypta clavata clavata*		EX	–	EX	EX	EX	EX	EA	
418	*Udaspes folus*	Grass demon	Resident	2015	EA	EA	EA	EA	EA	
419	*Suastus gremius gremius*	Palm bob	Resident	2015	EA	EA	EA	EA	NR	Possible introduction from Malaysia with palms
420	*Suastus everyx everyx*	White palm bob	Resident	2014	EA	EA	EA	EA	NR	See ref. Jain, 2015
421	*Zographetus doxus*	Spotted flitter	Resident	2014	EA	EA	EA	EX	NR	Rediscovered; see ref. Jain, 2015
422	*Zographetus ogygia ogygia*	Purple spotted flitter	Resident	2013	EX	EX	EX	EX	EA	Rediscovered in 2013 (Jain, 2014). Cryptic forest species therefore, likely missed in previous surveys
423	*Zographetus rama*		EX	–	EX	EX	EX	EX	NR	
424	*Hyarotis adrastus praba*	Tree flitter	Resident	2015	EA	EA	EA	EA	EA	
425	*Hyarotis microsticta*	White club flitter	Vagrant	2015	NR	NR	NR	NR	NR	New record. One sighting from P. Ubin in 2015 (NSS, 2015; SC, 2015b)
426	*Quedara monteithi monteithi*	Dubious bar flitter	Resident	2014	EA	EA	EA	EA	EA	See ref. Jain, 2015

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427	*Isma protoclea obscura*		EX	–	EX	EX	NLEX	NLEX	EX	
428	*Isma bononia bononia*		EX	–	EX	EX	NLEX	NLEX	EX	
429	*Plastingia naga*	Chequered lancer	Resident	2015	EA	EA	EA	EA	EA	
430	*Plastingia pellonia*	Yellow chequered lancer	Resident	2015	EA	EA	EA	EA	EX	
431	*Salanoemia tavoyana*	Yellow streak darter	Resident	2013	EA	NR	NR	NR	NR	New discovery in 2011 (BC, 2011h); see ref. Jain, 2014
432	*Salanoemia sala*		EX	–	EX	EX	NLEX	NLEX	EX	
433	*Pemara pugnans*	Pugnacious lancer	Resident	2015	EA	EA	EA	EX	EA	Rediscovered from Mandai Orchid garden prior to 2010. 2 sightings in 2015 by Sunny Chir.
434	*Pyroneura latoia latoia*	Yellow vein lancer	Resident	2015	EA	EA	EA	EA	EA	
435	*Pyroneura derna*		EX	–	EX	EX	NLEX	NLEX	EX	
436	*Zela storeyi (or Zela zenon)*	Detritus (Storeyi's) palmer	Resident	2015	EA	EA	EA	EA	EA	
437	*Zela cowani*		EX	–	EX	EX	EX	EX	NR	
438	*Gangara thyrsis thyrsis*	Giant redeye	Resident	2014	EA	EA	EA	EA	EX	See ref. Jain, 2015
439	*Gangara lebadea lebadea*	Banded redeye	Resident	2013	EA	EA	EX	EX	EA	Rediscovered after 2008
440	*Matapa aria*	Common redeye	Resident	2015	EA	EA	EA	EA	EA	
441	*Erionota torus*	Giant banana skipper	Resident	2013	EA	EA	EA	EA	EA	See ref. Jain, 2014
442	*Erionota thrax thrax*	Banana skipper	Resident	2015	EA	EA	EA	EA	EA	
443	*Erionota acroleuca apicalis*	White tipped banana skipper	Resident	2014	EA	EA	EA	EA	NR	See ref. Jain, 2015
444	*Erionota sybirita*		EX	–	EX	EX	NLEX	NLEX	EX	
445	*Unkana ambasa batara*	Hoary palmer	Resident	2015	EA	EA	EA	EA	EA	

S.No.	Scientific name	Common Name	Current status	Last sighting*	Khew (2015)	Khew (2010)	Khew (2008)	Khew & Neo (1997)	C&P (1956)	Comments
446	*Hidari irava*	Coconut skipper	Resident	2015	EA	EA	EA	EA	EA	
447	*Eetion elia*	White spot palmer	Resident	2014	EA	EA	EA	EA	EA	See ref. Jain, 2015
448	*Acerbas anthea anthea*		EX	–	EX	EX	NLEX	NLEX	EX	
449	*Pirdana hyela rudolphii*		EX	–	EX	EX	NLEX	NLEX	NR	
450	*Taractrocera ardonia lamia*	Spotted grass dart	Resident	2015	EA	EA	EA	EA	EX	Reported extirpated by C&P, 1992; entered by Khew & Neo, 1997 as new record, must be rediscovery instead
451	*Taractrocera archias quinta*	Yellow grass dart	Resident	2014	EA	EA	EA	NR	NR	Discovered in 2004 (Neo Chee Beng), see ref. Jain, 2015
452	*Oriens gola pseudolus*	Common dartlet	Resident	2015	EA	EA	EA	EA	EA	
453	*Oriens paragola*	Malay dartlet	Resident	2015	NR	NR	NR	NR	NR	Discovered in 2011 (BC, 2011i)
454	*Potanthus omaha omaha*	Lesser dart	Resident	2015	EA	EA	EA	EA	EA	
455	*Potanthus trachala tytleri*	Detached dart	Resident	2015	EX	EX	EX	EX	EA	Rediscovered in 2011 (BC, 2011g; Soon Chye, pers. comm.)
456	*Potanthus serina (or Potanthus hetaerus serina)*	Large dart	Resident	2015	EA	EA	EX	EX	EA	Rediscovered in 2010 (BC, 2010a)
457	*Potanthus juno juno*		EX	–	EX	EX	EX	EX	EA	
458	*Potanthus confucius dushta*		EX	–	EX	EX	EX	EX	EA	
459	*Potanthus ganda ganda*		Resident	2013	NR	NR	NR	NR	NR	Cryptic species likely missed by earlier authors. Discovered in 2013 and spotted multiple times since (identified by Dr. Seow). Reliably identified with genitalia in 2015 (SC, 2015c)
460	*Cephrenes acalle niasicus*	Plain palm dart	Resident	2014	EA	EA	EX	EX	EA	Rediscovered and bred since 2010 (see BC, 2010c); see ref. Jain, 2015
461	*Cephrenes trichopepla*	Yellow palm dart	Resident	2015	EA	EA	NR	NR	NR	Non-native. Established from Australia. Recorded since 1999 but identity confirmed only in 2010 (BC, 2010d)
462	*Telicota colon stinga*	Common palm dart	Resident	2015	EA	EA	EX	EX	EA	Rediscovered in 2010 (BC, 2010a)

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463	*Telicota besta bina*	Besta palm dart	Resident	2015	EA	EA	EA	EA	EA	
464	*Telicota augias augias*	Palm dart	Resident	2015	EA	EA	EA	EX	EA	Rediscovered species
465	*Telicota linna*	Linna palm dart	Resident	2015	NR	NR	NR	NR	NR	New discovery since 2007 (BC, 2015c; S.C. Chan, pers. comm.)
466	*Borbo cinnara*	Formosan swift	Resident	2015	EA	EA	EX	EX	EA	Rediscovered in 2010 (SC, 2010a)
467	*Parnara bada bada*		EX	–	EX	EX	EX	EX	EA	
468	*Parnara ganga*		EX	–	EX	EX	EX	NLEX	EX	
469	*Pelopidas mathias mathias*	Small branded swift	Resident	2015	EA	EA	EA	EA	EA	
470	*Pelopidas agna agna*	Bengal swift	Resident	2010–2015	EA	EX	EX	EX	EA	Rediscovered in 2010 (SC, 2010b; BC, 2015e).
471	*Pelopidas assamensis*	Great swift	Resident	2015	EA	EA	EA	NR	NR	Discovered in 1990s (Khew, 2015)
472	*Pelopidas conjunctus conjunctus*	Conjoined swift	Resident	2014	EA	EA	NR	NR	NR	Discovered in 2005 (S.C. Chan, pers. comm.); see ref. Jain, 2015
473	*Polytremis lubricans lubricans*	Contiguous swift	Resident	2014	EA	EA	EA	EA	EA	See ref. Jain, 2015
474	*Baoris farri farri*	Bamboo paintbrush swift	Resident	2015	EA	EA	EA	EX	EA	Rediscovered species
475	*Baoris oceia*	Paintbrush swift	Resident	2015	EA	EA	EA	EX	EA	Rediscovered species
476	*Caltoris cormasa*	Full stop swift	Resident	2015	EA	EA	EA	EA	EA	
477	*Caltoris philippina philippina*	Philippine swift	Resident	2015	EA	EA	EA	EA	EA	
478	*Caltoris malaya*	Malayan swift	Resident	2015	EA	EX	EX	EX	EA	Rediscovered since 2014 (BC, 2015e)