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## **TREUBIA**

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## BUTTERFLIES RECENTLY RECORDED FROM LOMBOK

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### ABSTRACT

Ten species of butterflies were recently recorded from Lombok, i.e., *Papilio demoleus malayanus*, *Appias olferna*, *Eurema andersoni kashiwaii*, *Theclinesstes miskini gaura*, *Tirumala ishmoides linea*, *Acraea andromacha*, *Acraea terpsicore*, *Junonia villida*, *Lexias aegle miyatai* and *Mycalesis mineus macromalayana*. *Papilio demoleus malayanus*, *A. olferna* and *A. terpsicore* were thought to be recent immigrants from the mainland Asia, and likewise *J. villida* from Australia. We could not determine whether *A. andromacha*, recorded by only one specimen, is a native species or a stray from Sumbawa. The other species were supposed to be native to Lombok.

**Key words:** butterflies, distribution, Lesser Sunda, Lombok, native species, range expansion, Wallace's line

### INTRODUCTION

Lesser Sunda (Nusa Tenggara) has been noticed as the biogeographical transition between Asia and Australia. However, compared to comprehensive faunal studies on butterflies from surrounding major islands (Roepke 1935-1942, Otsuka 1988, Maruyama & Otsuka 1991, Seki *et al.* 1991, Parsons 1999), the butterfly faunas on Lesser Sunda islands are rather poorly known. Actually, many species are recorded only from a part of Lesser Sunda, but we cannot surely determine whether there is a lack of record of a species from an island really indicating lack of the species on the island or under representation.

We collected butterflies of Lombok, the westernmost island of Lesser Sunda, by repeated visits in 2003, 2004, 2005, 2006 and 2011. The main purpose of the collection was to monitor biodiversity status in and around a reforested area, Japan-Indonesia Friendship Forest, at Sekaroh, southeastern coast of Lombok. The earlier (2003-2006) results of the biodiversity study at Sekaroh have been reported by Nakamuta *et al.* (2008).

Beside above monitoring study at Sekaroh, we also made some butterfly collections from native forests in several other regions of

Lombok for faunal comparison with the plantation at Sekaroh. In the course of these studies, we collected ten species that had never been recorded from Lombok before. Some of them collected at Sekaroh have been briefly mentioned by Nakamuta *et al.* (2008) but no detailed collection data have been presented. The other later collected specimens at Sekaroh and those found from the natural forests have never been reported. In the present paper, we report collection data for these butterfly species recently recorded from Lombok.

## COLLECTING SITES AND METHODS

We collected butterflies at Sekaroh (East Lombok Regency or Lombok Timur), Suranadi (West Lombok Regency or Lombok Barat), Senaru (North Lombok Regency or Lombok Utara) and Pusuk (West Lombok Regency) as detailed below (KM, WAN and EC means the first, second and third authors in short).

### **Sekaroh:**

The reforested area of Japan-Indonesia Friendship Forest and surrounding deforested grasslands near Tanjung Ringgit, southeastern coast of Lombok. The reforestation on the degraded land started in 1996 and finished in 1999 through the collaboration between the Indonesian Ministry of Forestry and Japan International Forestry Promotion and Cooperation Center. Biodiversity monitoring of insects and plants have been conducted since 2003. As a part of this monitoring, butterflies were collected by KM and WAN on August 27-29, 2003 (dry season), by KM and WAN on January 3-7, 2004 (wet season), by KM and WAN on June 23-26, 2004 (dry season), by KM, WAN and EC on January 5-10, 2005 (wet season), by WAN and EC on September 11-15, 2005 (dry season), by KM and WAN on January 25-28, 2006 (wet season) by KM, WAN and EC on January 15-20, 2011 (wet season) and by KM, WAN and EC on October 19-28, 2011 (dry season).

### **Suranadi:**

A protected secondary forest and an adjoining Suranadi Village. KM and WAN collected butterflies on September 7-9, 2005, KM, WAN and EC on January 22-23, 2006, and EC on January 24-30, 2005. Butterflies were collected by hand-netting and by three sets of a banana-baited butterfly trap.

### **Senaru:**

The village of Senaru and a secondary mountain forest in the Mt. Rinjani National Park. KM and WAN collected butterflies along a mountain trail from Senaru Village to Mt. Rinjani by hand-netting on September 7-8, 2005.

**Pusuk:**

A secondary mountain forest. KM and EC collected butterflies along a trail by hand-netting on October 30, 2011.

**COLLECTION DATA AND COMMENTS**

**1. *Papilio demoleus malayanus* Wallace (Papilionidae; Fig. 1)**

Sekaroh: 2♀, Jan. 6, 2004; 1♀, Jan. 6, 2005; 1♂, Jan. 9, 2005; 1♀, Jan. 28, 2006.

We also observed one pupal exuvia of this species at a village near Sekaroh on October 28, 2011.

Until 1960's, the range of *P. demoleus* was separated into two regions, the tropical and subtropical mainland Asia and mainland Australia and nearby islands of each, and was lacking on the islands in between, except Sumba, Flores, Alor and New Guinea (Tsukada & Nishiyama 1980). Although *P. demoleus* was recorded from Java much earlier with a few specimens (e.g. cited in Roepke 1935), these are thought to be introduced into the island and a native population of this species had never been found before 1980's in Java as rightly pointed out by Moonen (1991). Since then, the species has expanded its range throughout the islands, and the expansion process can be traced through many reports (Jumalon 1968, Hiura 1973, Miyata 1971, 1973, Tsukada & Nishiyama 1980, Ishii 1987, Kato 1989, Matsumoto & Noerdjito 1996, Moonen 1998, Matsumoto 2002, Nishimura 2008). There are two subspecies invaded to the islands: ssp. *libanius* Fruhstorfer from Taiwan to the Philippines, Talaud, Sula, Borneo, and Maluku Islands, and ssp. *malayanus* from Malay Peninsula to Sumatra, Java, Banka, Borneo, Bali, Lesser Sunda, Maluku Islands and New Guinea. The populations on Borneo and the eastern islands could be the results of mixtures between



**Figure 1.** *Papilio demoleus malayanus* (female)

different subspecies (Moonen 1998, Matsumoto 2002). Recently Tennent *et al.* (2011) recorded this species from Bismarck Archipelago. Also recently, this species was recorded from Dominican Republic (Guerrero *et al.* 2004), and then has been expanding its range in the Caribbean (Homziak & Homziak 2006, Garraway *et al.* 2009, Lauranzón Meléndez *et al.*, 2011).

Okano (1990) reported seven males and two females of *P. demoleus malayanus* collected from Sumbawa in 1989. This record suggests that the invasion of this species to Lombok should be much earlier than our finding of the first specimen from Lombok, supposedly during 1980's.

## 2. *Appias olferna* Swinhoe (Pieridae; Fig. 2)

Sekaroh: 1♀, Aug. 29, 2003; 1♂, Aug. 27, 2003; 1♀, Jan. 6, 2004; 1♂, June 5, 2004; 1♂, June 27, 2004; 2♀, June 24, 2004; 1♂, June 25, 2004; 1♀, June 29, 2004; 1♀, Jan. 7, 2005; 1♀, Jan. 8, 2005; 1♀, Jan. 29, 2005; 1♂, Jan. 27, 2006; 1♀, Jan. 17, 2011; 1♂, Jan. 18, 2011; 2♂, Jan. 20, 2011; 1♂, Oct. 21, 2011; 1♂, Oct. 25, 2011.

*Appias olferna* has been known from mainland Southeast Asia (including Malay Peninsula), Sumatra, West Java and the Philippines (Yata 1981). According to Chou (1994) "*A. libythea olferna*" (= *A. olferna*) also occurs in Guangdong and "*A. libythea zelmira*" (= *A. olferna peducaea*) on Hainan. As in the case of *P. demoleus*, this species is also spreading its range. Hsu (2007) reported that the species was recorded in 2002 and then quickly established its population on Taiwan. Although, the Philippine population is discriminated as ssp. *peducaea* Fruhstorfer, Yata (1981) suggested that the occurrence of this species in the Philippines, Malay Peninsula and Sumatra could be due to recent range expansion.



Figure 2. *Appias olferna* (male)

### 3. *Eurema andersoni kashiwaii* Shirôzu & Yata (Pieridae; Fig. 3)

Senaru: 1♂, Sept. 8, 2005.

*Eurema andersoni* has been known widely from the Asian tropics, but is rather sporadic in distribution. As far as in Lesser Sunda, this species has been known only from Sumba (Yata 1981). According to Yata (1981) this is a forest species. The specimen was collected in the natural forest, along the mountain trail to Mt. Rinjani. Probably, this species is now confined to mountain forests in Lombok, because lowland forests on this island have been almost totally exploited. Subspecies indicated above was determined by Dr. Osamu Yata.



Figure 3. *Eurema andersoni kashiwaii* (male): upperside (a) and underside (b)

### 4. *Theclinesthes miskini gaura* Doherty (Lycaenidae; Fig. 4)

Sekaroh: 1♂, Aug. 29, 2003; 1♀, Jun. 24, 2004; 1♂1♀, Oct. 21, 2011; 3♀, Oct. 22, 2011; 1♀, Oct. 24, 2011; 1♂, Oct. 25, 2011; 1♀, Oct. 27, 2011.

*Theclinesthes miskini* has been known from Australia, New Guinea, Bismarck archipelago and islands of Lesser Sunda and Maluku, including Sumba, Flores, Alor, Timor, Kisar, Tanimbar and Aru (Shibatani & Grund 1978, Parsons 1999). It is likely to find an Australian element like this species on Lombok, an island east of the Wallace's line. For the same reason, we suspect this species may also occur on Sumbawa.

*T. miskini* is a geographically variable species. Here we record these specimens as ssp. *gaura*, a subspecies known from Lesser Sunda, because morphological characters of the specimens well coincide with those of the subspecies detailed by Shibatani & Grund (1978). According to Shibatani & Grund (1978) nothing is known on the biology of *T. miskini gaura*. We observed a female laying an egg on *Sesbania grandiflora* (L.) Pers. (Leguminosae) planted in a crop field in the degraded grasslands. We also observed several males perching 2-3 m above ground on *S. grandiflora*

trees. It seems that the population of *T. miskini* has increased recently as can be seen in the increase of the specimens in 2011. This population increase could be supported by increase of crop fields where *S. grandiflora* is commonly planted for alley cropping and fencing. It is also notable that *T. miskini* was collected only in dry season. Orr & Kitching (2011) noted that this species prefers dry habitats in Australia.

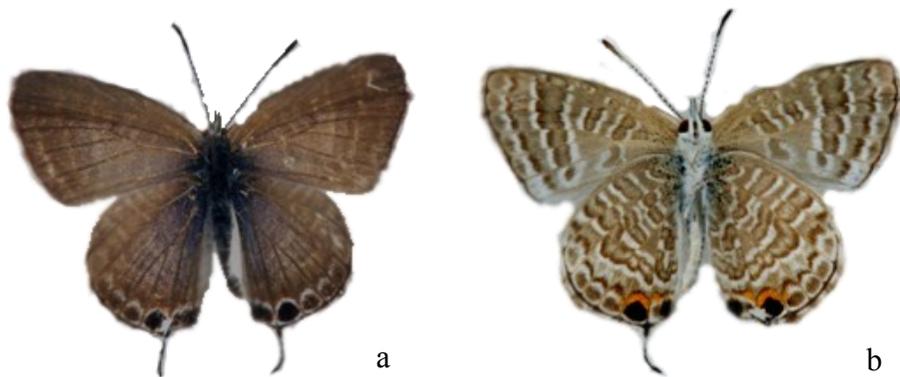


Figure 4. *Theclinesthes miskini gaura* (male): upperside (a) and underside (b)

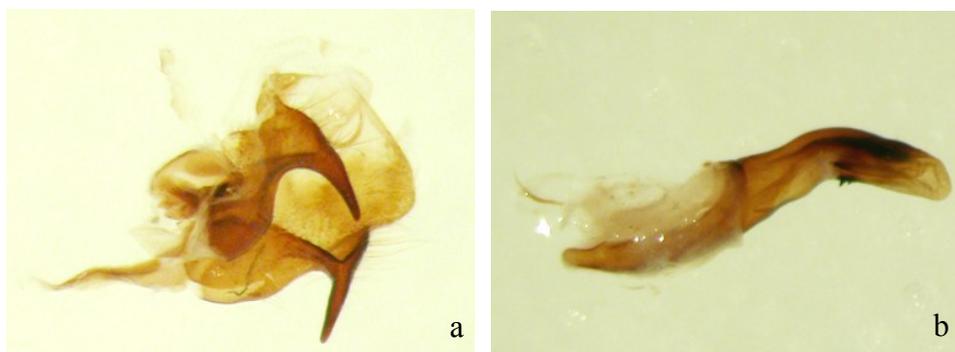
#### 5. *Tirumala ishmoides linea* Morishita (Nymphalidae; Fig. 5)

Sekaroh: 1 ♀, Jan. 4, 2004; 1 ♂, June 24, 2004.

According to Morishita (1981) *Tirumala ishmoides* has been known from Sulawesi, the Philippines, Java and Sumba, but they suggest wider distribution of the species over the islands of Lesser Sunda. The female specimen collected at Sekaroh was somewhat similar to *T. hamata* in that the three terminal spots of the forewing cell are fused together, but otherwise the wing markings are basically identical to those of *T. ishmoides* and similar to those of ssp. *linea* described from Sumba (Fig. 5b). We identified the male specimen, which was heavily worn (Fig. 5a), by examining its genitalia (Fig. 6).



Figure 5. *Tirumala ishmoides linea*: male (a) and female (b)



**Figure 6.** Male genitalia of *Tirumala ishmoides linea*: valvae (a) and aedeagus (b)

**6. *Acraea andromacha* Fabricius** (Nymphalidae; Fig. 7)

Sekaroh: 1♂, Sep. 14, 2005.

*Acraea andromacha* is widespread in Oceania, including Australia, New Guinea, many of the Melanesian islands and Samoa, and is also known from Indonesian islands of Lesser Sunda up to Sumbawa to the west, as well as from Kabia island of South Sulawesi (Tsukada 1985, Parsons 1999). As in the case of *T. miskini*, the occurrence of this Oceanian species is understandable. However, so far we have obtained only one male specimen, leaving a doubt that the specimen may not represent a native population of Lombok, but a stray individual from Sumbawa or elsewhere.



**Figure 7.** *Acraea andromacha* (male)

**7. *Acraea terpsicore* Linnaeus** (Nymphalidae; Fig. 8)

Sekaroh: 1♂1♀, Jan. 16, 2011; 1♀, Jan. 17, 2011; 10♂4♀, Jan. 18, 2011; 12♂4♀, 20 Jan. 2011; 8♂2♀, 20 Oct. 2011; 1♂1♀, 21 Oct. 2011; 2♂1♀, 22 Oct. 2011; 1♂1♀, 24 Oct. 2011; 4♂2♀, 25 Oct. 2011; 6♂1♀, Oct. 27, 2011; 1♂, Oct. 28, 2011.

Until 1980's, *Acraea terpsicore* had been known from India and Sri Lanka (Talbot 1947, D'Abbrera 1985), but D'Abbrera (1985) included "Burma" (Myanmar) to its range with a question mark. This species was not included in Himalayan butterfly fauna by Mani (1986) but Smith (1989) indicated its occurrence in Nepal. More recently, the species has been recorded from Thailand (Takanishi 1988, Nishimura 1994), Vietnam (Nishimura 1994), Peninsular Malaysia (Arshad *et al.* 1996, Chan 2003, Eliot 2006), Singapore (Khew 2008) and Hainan of China (Chou 1994, Huang 2002), indicating range expansion of the species during the last couple of decades.

On Lombok, we could not find this species in 2003-2006, but we collected many specimens in the grasslands at Sekaroh in 2011 as indicated above, indicating that the species settled in Sekaroh between 2006 and 2011. The adult butterflies were found in grasslands, often around clumps of the larval hostplant, *Passiflora foetida* L. (Passifloraceae), and we found several larvae feeding on this plant (Fig. 9).



Figure 8. *Acraea terpsicore* (male)



Figure 9. The last instar larva of *Acraea terpsicore*

### 8. *Junonia villida* Fabricius (Nymphalidae; Fig. 10)

Sekaroh: 1♂, Jan. 6, 2004; 1♂, June 23, 2004; 1♀, Jan. 5, 2005; 1♀, Jan. 9, 2005; 1♂, Sep. 11, 2005; 3♂6♀, Jan. 27, 2006; 1♂, Jan. 28, 2006; 2♂, Jan. 16, 2011; 1♀, Jan. 20, 2011; 4♂, Oct. 20, 2011; 1♂1♀, Oct. 21, 2011; 2♂3♀, Oct. 24, 2011; 5♂, Oct. 27, 2011.

*Junonia villida* is widespread, known from Maluku, New Guinea, Australia, islands of Micronesia, Melanesia, and southern Polynesia up to Tuamotu Islands to the east (Tennent 2002). Stray specimens have also been recorded from Chagos Islands, Java, Ketupat Island of East Java, Flores, Sumba, Tanimbar, the Philippines, and New Zealand (Tsukada 1985, Parsons 1999), indicating migratory power of the species.

We did not find this species in 2003, and we collected only one specimen or none on a given day in 2004 and 2005, whereas the number of specimens has increased from 2006 onward as indicated above. We assumed that this species should have established its population at Sekaroh since the arrival of the founder shortly before 2004.

The adult butterflies were found at several spots in grasslands, where the vegetation is poorly developed or dominated by short herbaceous plants. Males were observed to perch on the ground to hold a territory. This species occurs in a wide variety of open habitats in the Solomons and Australia (Tennent 2002, Orr & Kitching 2011).



Figure 10. *Junonia villida* (male)

**9. *Lexias aegle miyatai* Hanafusa** (Nymphalidae; Fig. 11)

Suranadi: 2♂, Jan. 23, 2006; 1♂, Jan. 25, 2006; 1♂, Jan. 28, 2006, Seranadi; 1♂, Jan. 29, 2006.

*Lexias aegle* is supposed to be endemic to Lesser Sunda, having been known from Sumbawa, Sumba and Flores (Tsukada 1991). The populations found on different islands are respectively treated as subspecies. The specimens collected from Lombok possessed characters identical to ssp. *miyatai* of Sumbawa. Three males collected on January 25, 28 and 29, 2006, were captured by the butterfly trap.

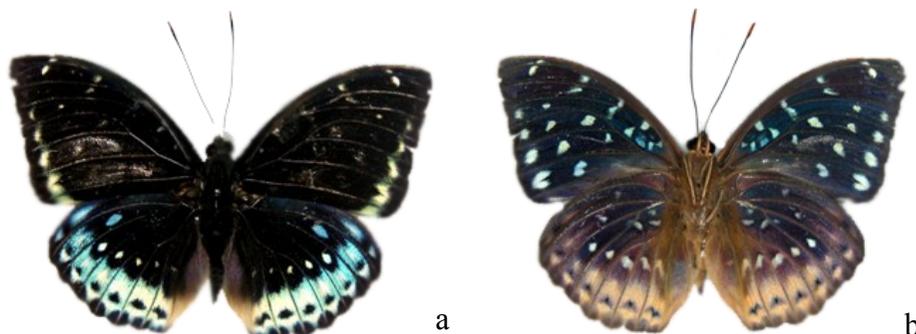


Figure 11. *Lexias aegle miyatai* (male)

**10. *Mycalesis mineus macromalayana* Fruhstorfer** (Nymphalidae; Figs 12 and 13)

Sekaroh: 1♂, Jan. 4, 2004; 1♂, Jan. 5, 2004; 1♂2♀, Jan. 6, 2004; 1♂, Jan. 27, 2006, ; 1♂1♀, Jan. 28, 2006; 3♂1♀, Jan. 16, 2011; 1♂1♀, Jan. 17, 2011; 1♀, Jan. 18, 2011; 1♂1♀, Jan. 19, 2011; 1♂1♀, Jan. 20, 2011; 1♂, Oct. 21, 2011; 1♂, Oct. 26, 2011.

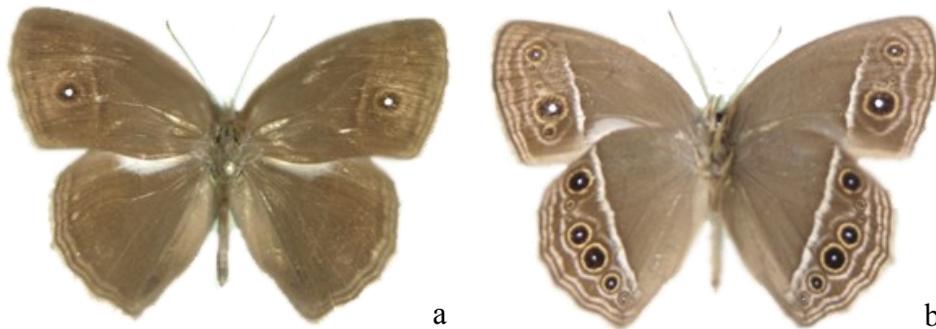
Senaru: 2♂2♀, Sept. 8, 2005.

Suranadi: 3♂1♀, Sept. 9, 2005; 2♂1♀, Jan. 22, 2006; 2♀, Jan. 24, 2006; 1♂, Jan. 25, 2006; 3♂3♀, Jan. 27, 2006; 1♀, Jan. 28, 2006; 2♂, Jan. 30, 2006.

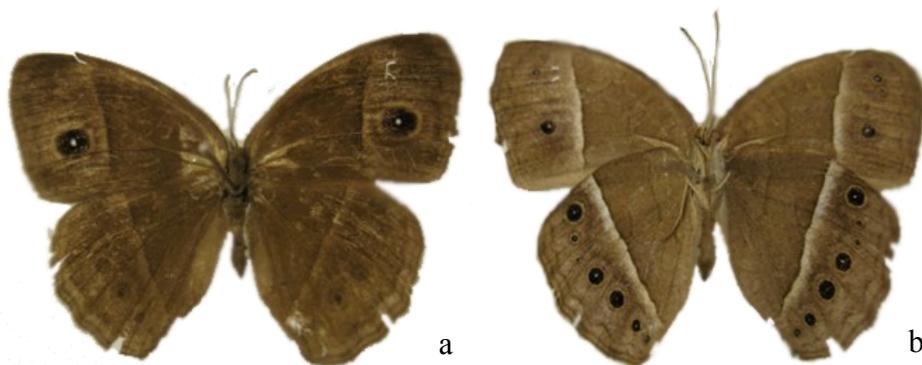
Pusuk: 1♀, Oct. 30, 2011.

*Mycalesis mineus* is widespread in the tropical and subtropical Asia, on the mainland from India to Southern China, Indochina and Malay Peninsula, as well as islands of Sri Lanka, Andaman, Nicobar, Taiwan, Hainan, the Philippines, Sumatra, Java, Borneo, and a part of Lesser Sunda, in which so far known from Sumba and Flores (Aoki *et al.*1982). The finding of this species from Lombok fills a part of the gap between Java and Flores, and we suspect this species might also occur on Bali and Sumbawa. The populations found in Sundaland and Lesser Sunda are assigned to ssp. *macromalayana* by Aoki *et al.* 1982. Aoki *et al.* (1982) remarked that the Philippine population, ssp. *philipina*, can be separated from ssp. *macromalayana* by occurrence of dry season form and white marginal and submarginal lines of underside of wings in the former. However we found that the dry season form, in which underside ocelli are small, occurs in the Lombok population. Nevertheless, the wet season specimens have no clear difference from ssp. *macromalayana*. Because of this reason, we hold this subspecies for the specimens from Lombok.

The specimens from Suranadi on January 24, 25, 27, 28 and 30, 2006, were collected by the butterfly trap.



**Figure 12.** *Mycalesis mineus macromalayana* (wet season form male): upperside (a), underside (b)



**Figure 13.** *Mycalesis mineus macromalayana* (dry season form female): upperside (a), underside (b)

### CONCLUDING REMARKS

The ten species treated here represent two types in respect to their habitat preference, i.e., forest species and open habitat species. *Eurema andersoni*, *Tirumala ishmooides*, *Lexias aegle* and *Mycalesis mineus* are forest species, occurring in and around forests, and *P. demoleus*, *A. olferna*, *T. miskini*, *A. andromacha*, *A. terpsicore* and *J. villida* are open habitat species, occurring in grasslands, crop fields, and other human modified habitats where trees are absent or sparsely grow.

The forest species are all Asian elements, i.e., either a species having its range mainly in Asia, and its extended range is reaching to Lesser Sunda, or a species having its closely related (congeneric) species in Asia. These species typically occur in the rain forests. They are native species to Lombok, less likely to be an immigrant flying across an open landscape and a big water body.

The open habitat species are either Australian elements ranging up to Lombok or recent immigrants either from Australia or Asian monsoon regions. As previously mentioned, *A. andromacha* is likely to occur on Lombok, but before concluding this, we need further specimens clearly represent Lombokian population. We think *T. miskini*, found with a good number of specimens, is a native species of Lombok, and its occurrence could have been overlooked so far. It should be noted that on the islands of Lesser Sunda, Australian elements are likely to occur in open, dry, disturbed and/or human dominated habitats, as in the case of *T. miskini* at Sekaroh, but these habitats are less attractive for the entomologists and are likely to be ignored.

Matsumoto (2002) claimed that the deforestation extensively occurred in the Southeast Asian islands during the later half of the last century favored range expansion to the islands by *P. demoleus*. Similar logic may also apply to other immigrant species.

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## CONTENT

VOL 39, DECEMBER 2012

CONTENT	PAGES
<b>Anang Setiawan Achmadi, Ibnu Maryanto and Maharadatunkamsi.</b> Systematic and descriptions of new species of <i>Maxomys</i> (Muridae) .....	1
<b>Kazuma Matsumoto, Woro A. Noerdjito and Endang Cholik.</b> Butterflies recently recorded from Lombok .....	27
<b>Michael S. Engel.</b> The honey bees of Indonesia (Hymenoptera: Apidae) .....	41
<b>Maharadatunkamsi.</b> Morphological variation in <i>Chironax melanocephalus</i> (Chiroptera: Pteropodidae) from Indonesia and description of new subspecies .....	51
<b>Djunijanti Peggie.</b> A list of the butterflies of Ujung Kulon National Park, Java, Indonesia .....	67
<b>Awit Suwito, Takahide A. Ishida, Kouhei Hattori and Masahito T. Kimura.</b> Territorial and mating behaviours of two flower-breeding <i>Drosophila</i> species, <i>D. elegans</i> and <i>D. gunungcola</i> (Diptera: Drosophilidae) at Cibodas, West Java, Indonesia .....	77