

A PRELIMINARY ANNOTATED CHECKLIST  
OF THE PAPILIONIDAE OF LAOS WITH NOTES ON TAXONOMY,  
PHENOLOGY, DISTRIBUTION AND VARIATION  
(Lepidoptera, Papilionoidea)

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INTRODUCTION

A checklist of the Papilionidae of Laos with notes on the 63 putative taxa is presented, being the result of a combination of previous publications, personal communications and the field observations of the authors during the past two years. Twelve taxa are placed as synonyms, in one case resulting in a change of species name; and two taxa are reinstated as valid subspecies. One taxon, *Chilasa imitata* Monastyrskii & Devyatkin, 2003 recently described as a new species is herein treated as a subspecies of the widespread species *Papilio epycides* Hewitson, 1869.

GEOGRAPHY AND CLIMATE

Laos, perhaps the least known country in mainland Southeast Asia, stands at the region's crossroads. This small 'land in between' is surrounded by China, Vietnam, Cambodia, Thailand and Burma.

Lao People's Democratic Republic, as it is officially called, lies in the east-central part of the Indochinese peninsula, between latitudes 13°50' and 22°30' N, and longitudes 100°10' to 107°40'E, with a total area of 236,000 km<sup>2</sup>. Elevations range from 80 metres, where the Mekong River leaves the country in the extreme south, to 2,820 metres at Phou Bia in Xiang Khouang Province. Seventy per cent of the country is high mountain terrain.

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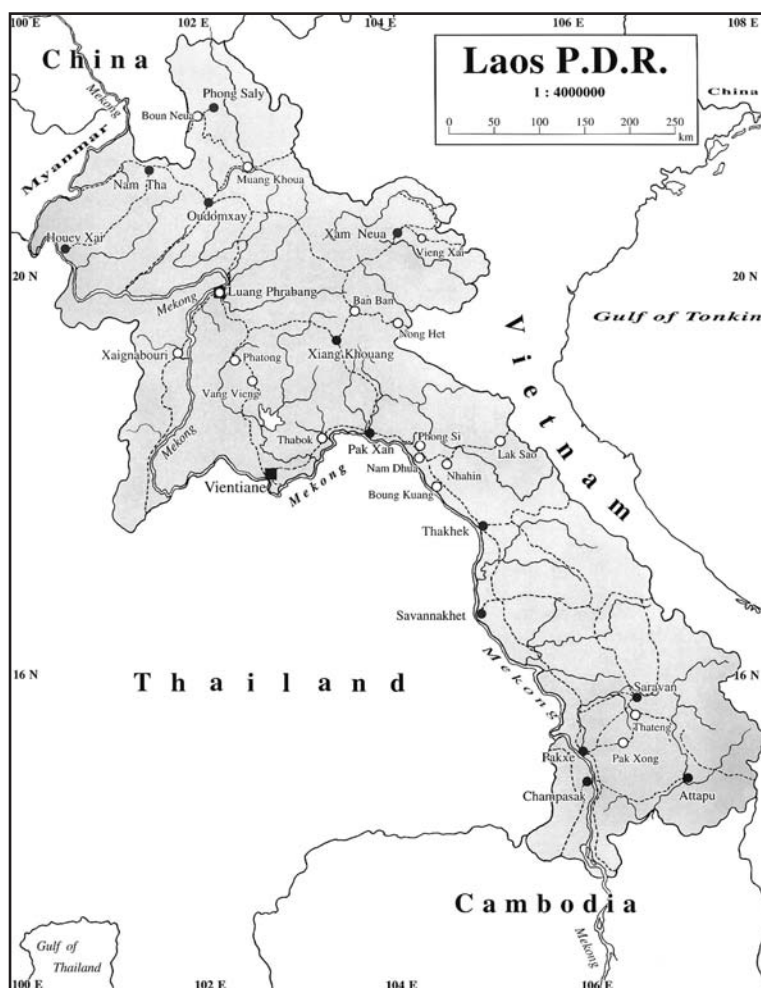


Fig. 1 – Map of Laos.

At the extreme north are short borders with Myanmar and the Chinese province of Yunnan. To the east is a long border with Vietnam; to the south, Cambodia; to the west, Thailand. The country contains 17 administrative provinces, plus one restricted access special region (Xaysomboun). A map of the country (fig. 1) is reproduced from Osada et al. (1999) with kind permission from the publishers, Mokuyo-sha Ltd. of Tokyo. The toponyms of the localities mentioned in the text are listed in tab. 1.

Tab. 1 – Gazetteer of Lao Localities.

PLACE NAME	LOCATION
Ban Houei Sai	alternative spelling for Houey Xai
Ban Lao	village east of Thakhek
Ban Na Sao	village south of Ponsavan, Xiang Khouang Province
Ban Nam Hom	village, unknown location
Ban-Sai	village, unknown location, possibly = Houey Xai
Ban-van-Nam	village, unknown location
Bolikhamxay	Province in eastern Laos
Boten	town on Chinese border northeast of Nam Tha
Champasak	town and southernmost Province in Laos
Dan Sum	unknown name, means 3rd checkpoint
Doi Pee Ban Nam	mountain near Thai border southwest of Xaignabouri
forêt de Ban Sou Mone	forest near Vientiane
Hat Pho	unknown, possibly Hat Phot, Luang Phrabang
Hinboun	District in northwest Khammouane Province
Hongsai	northern Xaignabouri Province
Houey Xai	town in Bokeo Province, northwest Laos
Keng-Kabao	village near Savannakhet
Koun Kham	town and valley on Highway 8 in Hinboun District, 170 m
Koun Ngoun	village and valley on Highway 8 in Hinboun District, 180 m
Lak Sao	town on Highway 8, southeastern Bolikhamxai Province, 498 m
Luang Nam Tha	Province in far northwest Laos
Luang Phrabang	old capital and Province in north-central Laos
M. Em	unknown name, M. probably = Muang (town)
Mekong River	main river system in Laos
Muang Khoua	town in Phong Saly Province
Muang Xing	town northeast of Nam Tha
Nahé	village in southern Hinboun District
Nakai	village ~50 km south of Lak Sao, Khammouane Province
Nam Cha	stream 5 km north of Xaysomboun
Nam Dhua	forest on bank of Mekong River, central Laos, 140 m
Nam Hin Boun	river in Hinboun District
Nam Moh	stream in Xiang Khouang Province
Nam Ngum Dam	Dam on artificial lake north of Vientiane
Nam Phao	Border post east of Lak Sao, 705 m
Nam Sanam	stream in Koun Kham Valley
Nam Tha	town in Luang Nam Tha Province
Nam-tié	unknown name, (Nam means river or water)
NBCA	National Biodiversity Conservation Area
Nhahin	alternative name for Koun Kham
Nong Het	town near Vietnamese border, Xiang Khouang Province
Oudomxay	town and Province in northern Laos
Pak Xong	town in Champasak Province
Pakxe	town in Champasak Province

*continued*

Phatong	village 10 km north of Vang Vieng
Phong Saly	town and northernmost Province in Laos
Phong Si	forest northwest of Nhahin, 144 m
Phou Bia	highest mountain in Laos (2820 m.), north of Xaysomboun town
Phou Chomvoy	mountain northeast of Lak Sao (Phou means mountain)
Phou Khao Khouay	mountain south of Nam Ngum Dam and NBCA east of Vientiane
Phou Khe	mountain southeast of Ponsavan, Xiang Khouang Province
Phou Pha Man	mountain between Koun Kham and Koun Ngum
Phou Phan	mountain south of Xam Neua
Phou San	mountain northeast of Ponsavan
Phou Sangkom	mountain 90 km southeast of Xam Neua
Ponsavan	main town of Xiang Khouang Province
Sam Neua	alternative spelling for Xam Neua
Saravan	town and Province in southern Laos
Sekong	Province in southern Laos
Sop Bao	town northeast of Xam Neua
Tad Leuk Waterfall	waterfall west of Thabok (Tad means stream), 170 m
Tad Nam Sanam	stream in Koun Kham Valley, 182 m
Tathom	town in southern Xiang Khouang Province
Tha Dua	town 26 km northeast of Xaignabouri
Tha Lat	village near Nam Ngum Dam, north of Vientiane
Tha Ngone	town 20 km north of Vientiane
Thabok	town 92 km east of Vientiane, 150 m
Thado	remote village near Nong Het
Thakhek	town on Mekong River, Khammouane Province
Thateng	town 40 km south of Saravan, southern Laos
Vang Vieng	town 150 km north of Vientiane
Vientiane	Capital and Province, Central Laos, 160 m
Xaignabouri	town and Province west of Mekong River, western Laos
Xam Neua	town in Houa Phan Province, northeast Laos
Xaysomboun	town and restricted access special region, central Laos
Xe Xap	NBCA on Vietnamese border, southern Laos
Xiang Khouang	Province in eastern Laos

The climate is dominated by monsoons, with pronounced wet and dry seasons. Most rain falls during May to September, when the prevailing winds first blow from the southwest, and later from the east. Annual rainfall ranges from 1,000 mm in the extreme south to 3,000 mm in the north. The dry season, from October to April, is characterised by winds that blow from the northeast. The Annamese mountains in the eastern provinces on the border with Vietnam are subject to higher rainfall than the Mekong basin, due to proximity to the sea. Indeed, it is often sunny in Lak Sao town only 20 km west of the border, but cloudy or raining in the mountains, even in the 'dry season'.

Mean temperatures range from about 10°C in January to 38°C in July, cooler in the north, and warmer in the south. Lowland areas are tropical, while the highest elevations and the mountains of the extreme north are sub-tropical. The hottest time of year in lowland Laos coincides with the end of the dry season in April, when temperatures can reach over 40°C.

The Mekong River is the dominant drainage system. It reaches Laos from China in the northwest, where it demarcates the international borders with Myanmar and Thailand. It enters Laos, swings eastwards to Luang Phrabang; then south to rejoin the border with Thailand, past Vientiane, and re-enters Laos again near Pakxe from where it flows south into Cambodia. Several major tributaries enter the Mekong from the east during its 1,600-km journey between China and Cambodia. There are no natural lakes; the largest body of surface water, Nam Ngum to the north of Vientiane, is man-made.

52.3 per cent of the land is covered by forest and woodland (second only to Cambodia); while arable farming is practised on only 3.3 per cent, the least for the SE Asian countries. Unfortunately the authors observed a fair amount of logging activity on various visits to central and eastern Laos, which, if a reflection of the situation country-wide would suggest that these figures are liable to change for the worse rather rapidly.

BIOGEOGRAPHICAL PROVINCES, FOREST TYPES, BIODIVERSITY, AND CONSERVATION

Udvardy (1975) placed Laos within the Thailandian Monsoon Forest in his classification of World biogeographical provinces, and MacKinnon (1997) divided this into five sub-units:

Indochina	1. Central Indochina sub-unit Most of the Mekong drainage 2. North Indochina sub-unit Most of northern Lao PDR 3. Indochina transition sub-unit A small mountainous area in the extreme north
Coastal Indochina	4. North Annam sub-unit A narrow band along part of the border with Viet Nam
Annamese Mountains	5. Central Annam Mountains sub-unit A small border area in the extreme southeast

The main forest types in Laos are:

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Dry evergreen forest:	Extensive areas in the north
Tropical montane evergreen forest:	Along highland areas of the Annamese Mountains and Bolovens Plateau
Lowland semi-evergreen dipterocarp forest:	The Mekong Plain
Tropical montane deciduous forest:	Scattered areas in the north
Dry dipterocarp forest:	Southern areas
Mixed deciduous forest:	Southern areas
Forest on limestone:	Small areas in the Annamese Mountains
Pine forest:	Small areas in the Annamese Mountains
Sub-tropical montane forest:	Small area in the extreme north

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A mixture of Himalayan, Burmese, Malay and Annamese elements make Laos a country of interesting levels of species richness, and with a significant number of endemic species.

MacKinnon (1997) recorded 8,286 known species of higher plants and about 1,300 vertebrates in Laos. There are about 200 species of mammals, 750 birds, 70 reptiles, 40 amphibians, 250 fishes, and 876 butterflies. These approximations must be subject to considerable revisions as further surveys and studies progress. For more details see Clarke (1999).

Three large mammals recently discovered to science are the small dark muntjac (*Muntiacus truongsongensis*), giant muntjac (*Megamuntiacus (Muntiacus) vuquangensis*) and saola (*Pseudoryx nghetinhensis*). They are all endemic to the Annamese range along the border between Laos and Vietnam. Threatened species recorded in Laos, based upon November 1998 data from the WCMC, comprised 220 plants (211 excluding synonyms) and 150 animals.

Bolikhamxay, one of the central eastern provinces, contains some of the most globally significant biodiversity in Southeast Asia. It contains the largest block of uninhabited montane forest in Laos and borders the largest expanse of protected central Annamese forest in Vietnam. Even though much of the province remains unexplored biologically, the forests are known to harbour a myriad of endemic mammals and birds. These include Saola, Truongson Muntjac, Giant (or large-antlered) Muntjac, Heude's Pig, the Annamite Striped Rabbit, Crested Argus, White-winged Magpie, and Short-tailed Scimitar-babbler. Also, the only recent reports of Rhino surviving in Laos (although few and unsubstantiated) are from Bolikhamxay.



Fig. 2 – *Graphium phidias* (Oberthür, 1906).



Fig. 3 – *Atrophaneura laos* (Riley & Godfrey, 1921).

The recent discovery of *Laonastes aenigmamus* (Jenkins et al. 2005) in neighbouring Khammouane province makes this area very rich in endemics and unique animals. *Laonastes aenigmamus* is a member of the hystricognath rodents, a taxon with disjunct distribution, with most families occurring in the main distributional area of South America, several others in Africa and only one family distributed in Africa and Asia. As Jenkins et al. (2005) point out, the presence of an additional hystricognath family, Laonatiidae, in Southeast Asia poses interesting questions and consideration is given to the way in which this new taxon fits into the theories of the biogeographical and evolutionary history of other hystricognaths.

Although very little of this outstanding landscape is under national level protection, significant portions of Bolikhamxay's forests are included in a provincial conservation forest system. This demonstrates the province's recognition of this unique ecosystem; however, the capacity to conserve it is limited. The province has pressing priorities such as poverty alleviation and the provision of basic education, health and food security. While these activities contribute to biodiversity conservation, they do not necessarily focus on the high priority issues or geographic areas for wildlife. It is crossed by Highway 8, which leads to Vietnam, and there are many settlements of farmers and rice producers as well as basic accommodation for travellers. Although it is not yet seen as a touristic place there are several sites with pristine vegetation, caves and rivers. The imminent construction of a new town in Koun Kham valley, northern Khammouane province, to relocate the Hinboun district administrative offices and house the people displaced by two new dam projects on Nam Theun River may constitute a potential danger to the ecosystem.

In 1993 the Lao government initiated a national conservation system, delineating 20 protected zones known as National Biodiversity Conservation Areas. These areas afford a certain level of protection to forest habitats and wildlife, but are not equivalent to National Parks in the generally accepted sense. Local people live inside these protected areas, and are able to continue traditional ways of life, including hunting and harvesting forest products, while theoretically not engaging in deforestation. Unfortunately such activity is part of the way of life for many of the ethnic hilltribes living in these areas, where traditional slash and burn agriculture is still practiced, despite efforts of the Lao government to discourage it. As Laos' principal

source of foreign exchange is hydroelectric power, it is hoped that the Lao government will actively ensure that the forest that provides this water will be preserved for the future.

#### HISTORY OF THE STUDY OF LEPIDOPTERA IN LAOS

Janet (1896 a, b) was the first author to specifically discuss a collection of butterflies from Laos; and the first to describe a Papilionid from Laos, *Papilio doddsi*, currently considered a subspecies of *Papilio dialis*. He received an extensive collection of specimens from Lieutenant Noiré, under the command of General Dodds, but did not publish a complete list of the material received.

It is notable that Jordan (1909) did not mention Laos even once in his treatment of the Indo-Australian Papilionidae, due to the paucity of Lao specimens of Papilionidae and Lepidoptera in general in European museums. Most of the specimens actually from Laos have locality labels which are not obvious, such as some Oberthür specimens labelled Haut Tonkin.

Dubois & de Salvaza studied the Lepidoptera of French Indochina, and published two papers on butterflies in 1919 and 1921. They recorded a total of 48 species of Papilionidae in Laos. Unfortunately the Dubois collection, housed in Saigon, appears not to have survived the Vietnam War, as no trace of the collection was found by Mrs Nguyen (pers. comm.) of the Paris Museum on a visit to Ho Chi Minh City. Some of the specimens were sent to Paris by Dubois, and are housed in the Paris Museum. These include the first known specimen of *Atrophaneura laos*, which Dubois & de Salvaza misidentified as *mencius*.

E. J. Godfrey spent many years collecting butterflies in Siam (the old name for Thailand), and published several papers on the butterflies of that country. He obtained a single specimen of *Atrophaneura* from a Siamese collector in 1920, originally understanding it to have been caught in Siam, but later establishing that it was actually collected in French Laos. Godfrey sent the specimen to the British Museum, and in 1921 Riley & Godfrey published the description of *Atrophaneura laos*, the only truly endemic species of Papilionid for the country.

In the late 1960s Japanese collectors started to investigate the butterflies of Laos, culminating in the publication of the first book on the Butterflies of Laos by Motono & Negishi in 1989. They recorded

a total of 512 species of butterflies, including 44 Papilionids. Prior to that in 1986 Aoki & Yamaguchi had published a paper detailing 280 species collected by them in 1975 (Tcherniak & Tuzov 2003). However, all the specimens came from the lower land near towns, as at that time foreigners were not permitted access to higher montane regions.

After the end of the Soviet era Laos began to open up to foreign travellers, and many butterfly collectors were able to travel around the country and investigate its butterfly fauna, including that of higher altitudes. Yutaka Inayoshi collected extensively in Thailand during the 1980s and also visited Laos several times in the early and mid 1990s. He has published the results of his studies online in his website 'A Checklist of Butterflies in Indochina Chiefly from Thailand, Laos & Vietnam' (<http://yutaka.it-n.jp>). In 1991 Shilo Osada set up a team of Japanese and Lao researchers to investigate the butterflies of Laos, culminating in the publication of a book in 1999, which lists a total of 876 species, most of them pictured life-size in colour, including a total of 57 species of Papilionidae. It is a pity that this excellent reference work lacks distribution and behavioural information, except for the data provided for the specimens in the plates. Among Osada's team was a Lao collector and University lecturer, Khamboun Sengheuangsomphou, (referred to below as Khamboun SP), who has continued to assist researchers and collected extensively across the country for many years.

Hiroyuki Wakahara moved from Japan to live in Vientiane in 1990, and has been studying the Lepidoptera of Laos since then, particularly the early stages of many species, and has published several papers on early stages of Lao butterflies with Satoshi Koiwaya. He has travelled extensively through the country, and recently has been able to gain access to Phou Bia, the highest mountain in Laos, which was previously inaccessible due to ethnic tension between the Lao army and Hmong insurgents living in the forest there. He is hopeful that he will be able to find new Papilionidae records from this particular mountain, particularly *Papilio krishna*, which occurs on mountains of similar altitude in North Vietnam. According to Wakahara (pers. comm.), Phou Bia differs from most other high mountains in Laos in that it has a large plateau near the top at 2600 m, whereas the other high mountains have steep slopes to their peaks.

Wakahara (pers. comm.) separates Laos into several different regions for diversity of Lepidoptera. The northwest highlands are



Fig. 4 – *Papilio dialis doddsi* Janet, 1896



Fig. 5 – *Papilio paradoxa telearchus* Hewitson, 1852

Tab. 2 – Phenology of Papilionidae at the three locations. Numbers refer to months.

	Thabok	Hinboun	Lak Sao
<i>Lamproptera curius curius</i>	1,2,3,4,6,8	1,3,4,6,8	1,2,3,4,5,6,7
<i>Lamproptera meges virescens</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	3,4,5
<i>Graphium aristus hermocrates</i>	2,3,4	2,3,4	
<i>Graphium nomius swinhoei</i>	2	3	
<i>Graphium antiphates pompilius</i>	1,2,3,4,6,8	1,2,3,4,5,6	1,3,4,5,6,7
<i>Graphium agetes agetes</i>		1,2,3,4	2,3
<i>Graphium eurous inthanon</i>			1,2
<i>Graphium mullah kooichii</i>			2,3
<i>Graphium phidias</i>			2,3
<i>Graphium xenocles kephisos</i>	2,3,4,6,8	1,2,3,4,5,6,8	3,4,5,7
<i>Graphium macareus indochinensis</i>	2,3,4	2,3,4,5	3,4
<i>Graphium megarus megapenthes</i>	1,2,3,4	1,3,4	
<i>Graphium arycles sphinx</i>	2,3,4,6,8	2,3,4,6,8	3
<i>Graphium chironides chironides</i>	1,2,3,6,8	1,2,3,4,8	1,2,3,4,5,6,7
<i>Graphium eurypylus cheronus</i>	2,3,4,6,8	1,2,3,4	3,4,5
<i>Graphium doson axion</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	2,3,4,5,6,7
<i>Graphium evemon albociliatis</i>		3,4	3,4,5,7
<i>Graphium agamemnon agamemnon</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	3,4,5,7
<i>Graphium sarpedon sarpedon</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,7
<i>Losaria coon doubledayi</i>	2	1,2,3,4,5,6,8	
<i>Pachliopta aristolochiae goniopeltis</i>	1,2	1,2,3,4,5,6,8	2,3,4,5
<i>Troides helena cerberus</i>	2,3	2,3,4,5,6,8	3,4,5
<i>Troides aeacus aeacus</i>	1,2,3,4,8	1,2,3,4,5,6,8	1,2,3,4
<i>Atrophaneura aidoneus</i>		1,5	5
<i>Atrophaneura varuna astorion</i>		1,2,3,4,5,6	5
<i>Atrophaneura varuna zaleucus</i>	2	4	
<i>Atrophaneura laos</i>		2,3,4,5,6,8	
<i>Atrophaneura dasarada barata</i>		1,2,4,5	4
<i>Atrophaneura polyeuctes polyeuctes</i>			1,2,3,5
<i>Meandrusa lachinus sukkiti</i>			2
<i>Meandrusa payeni langsonensis</i>	2	2,8	2,3
<i>Papilio paris paris</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	1,2,3,4,5
<i>Papilio arcturus arcturus</i>			5
<i>Papilio dialis doddsi</i>	2		1,2,3,4,5
<i>Papilio bianor gladiator</i>	2,3,4,8		1,2,3,4,5,6,7
<i>Papilio demoleus malayanus</i>	2,3,4,6	2,3,4,5,6,8	
<i>Papilio demolion demolion</i>	2,3	1	
<i>Papilio noblei</i>	1,2,3,6,8	2,3,4	3
<i>Papilio helenus helenus</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	1,2,3,4,5,6,7
<i>Papilio prexaspes pitmani</i>	2,3,4		
<i>Papilio castor mahadeva</i>	1,2,3,4,6,8	2,3,4,5,6,8	
<i>Papilio nephelus chaon</i>	2,3,4,6,8	1,2,3,4,5,6,8	3,4,5,7
<i>Papilio polytes romulus</i>	2,3,4,6,8	1,2,3,4,5,6,8	3,5
<i>Papilio protenor euprotenor</i>			1,2,3,4,5,6
<i>Papilio alcmenor alcmenor</i>	1,2,3,4,6,8	1,2,3,4,5	1,2,3,4,5
<i>Papilio memnon agenor</i>	1,2,3,4,6,8	1,2,3,4,5,6,8	1,2,3,4,5
<i>Papilio clytia clytia</i>	2,3,4,6	2,3,4,6	3
<i>Papilio paradoxa telearchus</i>	1,2,3,4,6,8	2,3,4,5,8	3
<i>Papilio agestor agestor</i>			1,2,3
<i>Papilio slateri slateri</i>	2,3,4	1,3	3,4
<i>Papilio epycides hypochra</i>			2,3

faunistically different from those of the northeast; the Mekong lowland evergreen forest forms another region; the Annamese mountains along the Vietnamese border another; and lastly the far south of Laos, which he states is similar to the fauna of Malaysia. He also says that the orchid flora mirror the differences in Lepidoptera in these areas. Tcherniak collected 150 species of Lepidoptera in the Vientiane valley while on diplomatic assignment from 1988-1990. He returned with I. Plyushch in 1996 to explore northern Laos, and obtained a further 140 species of butterflies and many moths. In March to May 2002 Tcherniak again visited Laos, this time with V. Tuzov, and they reported finding nearly 500 species on this visit, and a total of 511 species in their collections (Tcherniak & Tuzov 2003). Unfortunately the only Papilionid mentioned as 'new' in that paper is a misidentification of *Graphium chironides chironides* as *Graphium bathycles bathycloides*. The latter species does not occur north of the Malay Peninsula.

Nimura and Wakahara (2005) published the results of their study of the butterflies of central Laos found during the cool season, from November to early January, between 1997 and 2001. They listed a total of 221 species of butterflies including only 12 Papilionid species.

#### THE PRESENT STUDY

The authors began actively studying the Papilionidae of Laos in February 2005, choosing to concentrate preliminary surveys in the central and eastern regions, between Thabok and the Vietnamese border near Lak Sao, due to ease of access. The senior author drove to these localities on many occasions during the dry season and early rainy season, but was unable to travel during the late rainy season in September due to the high rainfall, and local conditions inside eastern Laos, particularly flooding and landslides often closing Highway 8. The junior author accompanied the senior author on several such visits. The authors recorded the occurrence of Papilionid species at the following locations:

1. Thabok, which refers to two waterfalls in lowland evergreen forest in Phou Khao Khouay NBCA at elevations of 170 and 300 metres, located about 100 km east of Vientiane.
2. Hinboun District along Highway 8, which consists of two valleys named for the villages in each, Koun Ngun valley west of Koun Kham valley, and the limestone mountain separating them called Phou Pha

Man, which is the highest of the hills in the limestone range separating central and southern Laos. Koun Ngun valley is much dryer than Koun Kham valley, which is fed by a year-round water supply from Nam Sanam stream running off the northern slopes of Phou Pha Man. In contrast, the stream beds in Koun Ngun valley all run dry very soon after the end of the rainy season, and do not start to flow with water until the following year. Consequently Koun Kham valley contains lush lowland evergreen forest at the base of the mountain and the forest remaining after extensive logging in Koun Ngun valley is dry evergreen forest and secondary growth. The west slope of Phou Pha Man contains a sheltered pocket of evergreen forest which retains much more moisture than the rest of Koun Ngun valley, despite the dry stream bed. Highway 8 crosses the southern side of Phou Pha Man, rising from approximately 180 metres altitude in both valley floors to 470 metres at a spectacular viewpoint across the limestone hills. Osada et al. (1999) referred to this area as Nhahin, which literally means 'stone face', an alternative name for Koun Kham Valley due to the spectacular limestone cliffs at the north side of the valley.

3. Lak Sao, or specifically the range of hills on the Vietnamese border about 25 km east of the town. The localities for recording butterflies are between 2 and 6 km before the border, between 660 and 550 metres altitude respectively. The forest near the border is evergreen, and heavily influenced by the weather coming in from Vietnam, due to these hills being the first high point only 50 km from the South China Sea, and subject to higher than average rainfall, with bad weather commonly occurring even in the driest time of year.

The Phenology of Papilionid species at these sites is summarized in tab. 2.

During this survey a new species was recorded for Laos, *Graphium evemon albociliatis*, discovered in the Lak Sao area (Cotton & Racheli 2006). The authors found a total of 32, 34, and 50 Papilionid taxa in the study area during the wet, cool and dry seasons, respectively. The total number of Papilionid taxa now known from Laos is 61, comprising 58 separate species as detailed in the annotated checklist below, plus *Papilio elephenor*, which was recorded for Laos by Dubois & de Salvaza (1919, 1921) but has not been seen since, and *Papilio krishna*, which is herein shown not to have been found in Laos.

The next phase of the study will be conducted in northern Laos, after the new road connecting northern Thailand and Yunnan, China

(passing through Laos from Huey Xai to Nam Tha) is completed. This road will make it possible for the senior author to drive from his home in Chiang Mai, Thailand, to northern Laos in only a few hours, as opposed to the present travel time of 3 days via Udon Thani, Vientiane and Luang Phrabang. It is hoped that further investigation in northern Laos will increase the number of Papilionidae known from the country, especially with regard to species known to occur in south Yunnan or northern Vietnam, but not yet found within the borders of Laos, such as *Papilio machaon* and *Papilio xuthus*.

The authors also expect that there may be further discoveries in future in the far southeast of Laos, where there are many inaccessible high mountains near the Vietnamese border, including several peaks over 2000 metres, and one of 2500 m. There are many endemic Lepidoptera in South Vietnam, some of which may also occur in this area.

#### THE FAMILY PAPILIONIDAE IN LAOS

Miller (1987) lists four apomorphies for the family Papilionidae as follows: larvae with osmeteria (an extrudable defensive scent organ immediately behind the head); legs with pretarsal ariolar pads and pulvillae reduced; vein 2A of the forewing present as a free vein to the wing margin; and cervical sclerites joined ventromedially. He did not verify the second character, originally described by Ehrlich (1958), and noted that this character state is also present in some species of Pieridae and Nymphalidae.

The family Papilionidae is generally recognised as being separated into three subfamilies, Baroniinae, Parnassiinae and Papilioninae. Subfamily Baroniinae contains a single species, *Baronia brevicornis*, from Mexico, which is considered a plesiomorphic relict species, as it retains an extra anal vein in the hindwing. All Papilionidae except *Baronia* lack this vein, having only a single anal vein, which is interpreted by Ackery & Vane-Wright (1984) as comprising veins 1A and 2A fused together. *Baronia* also has these two veins fused into a single vein.

No representatives of the subfamily Parnassiinae are presently confirmed from Laos, although it is possible that *Bhutanitis lidderdalii* may in future be found on a 2000 metre high limestone mountain in Xaysomboun (Wakahara, pers. comm.), as this species is also found

on such mountains in North Thailand and Vietnam. This mountain has not yet been explored, due to Xaysomboun being a restricted area. *Bhutanitis lidderdalii* also only flies in the height of the rainy season in late August to early September, thus making its discovery in Laos even more difficult. Prasobsuk Sukkit (pers. comm.) informed the authors that he was told a Japanese collector had found this species in Laos in 2003, but that he had not seen any specimens. The authors exclude it from this checklist, as we are unable to substantiate the occurrence of *Bhutanitis* in Laos at this time.

All species of Papilionidae so far found in Laos belong to subfamily Papilioninae, which is divided into three tribes, Leptocircini, Troidini and Papilionini. Miller (1987) lists five characters to define the subfamily Papilioninae: presence of a pseuduncus on abdominal tergite VIII of the male; specialised scale patches present along vein 2A on the male hindwing underside; forewing with a basal spur; metathorax with a distinct meral suture; and larvae with a white saddle mark on abdominal segments. Munroe & Ehrlich (1960) recognised the ‘cubito vannal vein’ (otherwise known as the basal spur) as a defining character for this subfamily. Miller (1987) believes the white larval saddle mark is a synapomorphy for the subfamily, as it is present in species of all three tribes, but he concludes that it has been subsequently lost in many species.

#### ANNOTATED CHECKLIST

The taxa are listed in the authors’ interpretation of phylogenetic order, based on a combination of various previous classifications, including those of Miller (1987), and the results of DNA analysis by Zakharov et al. (2004) who show that the genus *Papilio* is a monophyletic group comprising two lineages, which can be interpreted as subgenera *Papilio* and *Pterourus*. Most representatives of the genus *Papilio* in Laos belong to subgenus *Papilio*, but Zakharov et al. (2004) found that the mimetic species often separated into the genus *Chilasa* are actually the only SE Asian species internal to subgenus *Pterourus*, and so cannot be regarded as belonging to a separate genus. Investigation of the generic status of *Atrophaneura* and *Byasa* is not complete at present; therefore the authors treat all relevant taxa under *Atrophaneura* in this checklist. On the genus *Graphium*, the authors prefer to place all the species in this one genus, and treat

*Graphium*, *Arisbe*, *Pazala*, *Pathysa* and *Paranticopsis* as subgenera, at least until such time as the classification of *Graphium* can be more clearly resolved than at present. Smith & Vane-Wright (2001) show that the phylogenetic relationships within *Graphium* are unclear; and Page and Treadaway (2003) suggest an alternative arrangement without clearly explaining why, placing many Asian species in *Arisbe*, traditionally comprising only the African *Graphium* species.

Following the recommendations of various lepidopterists in European museums we are using original spellings for species group name endings rather than the strictly Code-compliant gender agreement.

## LEPTOCIRCINI

### ***Lamproptera curius curius* (Fabricius, 1787)**

*Lamproptera curius* was recorded from Indochina by Dubois & de Salvaza (1919), which was the locality designation they used for species found in all countries in the region, and thus can be regarded as the first record of *curius* in Laos. Motono & Negishi (1989) listed *curius* from Tha Ngone (just north of Vientiane) in March; Vientiane in July and August; Luang Phrabang in August; and from Hat Pho in November. Osada et al. (1999) pictured a male from Lak Sao collected in September. In late November Nimura & Wakahara (2005) found *curius* at Nam Dhua, which is about 30 km north of the junction between the main road from Vientiane to the south and Highway 8 to Lak Sao and Vietnam. They also collected *curius* at the end of December in Lak Sao and Nhahin. The present authors found *curius* in Thabok on every visit and similarly at Lak Sao, but found it to be less common in Hinboun District, where it was recorded in January, March and April at Koun Kham valley and in June and August in Koun Ngun valley. It is notable that *curius* and *meges* were only found in the dryer Koun Ngun valley during the rainy season. Females were occasionally observed feeding on flowers near the roadside at the viewpoint on Phou Pha Man and near the Vietnamese border.

Males of both species of *Lamproptera* frequent open riverbanks in forests, and will drink from sandy places along the water's edge. They tend to puddle separately from aggregations of other species, often being found on sand nearby rather than in a multi-species group.

Females can sometimes be seen visiting flowers by the roadside or in open areas in the forest. Both species are seasonally common, but are found in at least small numbers all year round. They sometimes form large mixed aggregations of their own, particularly in the rainy season, and sit with wings spread flat against the ground. In most lowland habitats both species are found together, and *meges* is the commoner species. In some localities, such as on the Vietnamese border east of Lak Sao at 660 metres altitude, *meges* is absent and only *curius* is found. It is interesting that both species are found on a tributary of the same river only 4 km away and 100 metres lower. The senior author also found only *curius* at 900 metres on Phou Chomvoy, northeast of Lak Sao. It is possible that in central Laos *meges* prefers lower elevation habitats than *curius*.

### ***Lamproptera meges virescens* (Butler, 1870)**

Dubois & de Salvaza (1921) listed *meges* as present in Laos without specifying a locality, presumably indicating its widespread occurrence. Motono & Negishi (1989) found *meges* mainly in the rainy season, when it is commonest, recording it from Vientiane, Nam Moh and Luang Phrabang in July, and also in August at the last locality and Nam Ngum Dam; but also found it in November at Hat Pho. Inayoshi (1996-2006) collected a male at Pak Xong, Champasak in South Laos on 28<sup>th</sup> March 1996, and Osada et al. (1999) pictured a male from Thabok caught in September. The present authors found *meges* in Thabok and Hinboun District throughout the year, but only found it in Lak Sao at the lower of the localities near the Vietnamese border.

*Lamproptera meges* is usually by far the commoner of the two species where both occur together. Males of both species look like dragonflies when flying along a stream bed, and can easily be overlooked by an observer unless they alight on the bank. *Lamproptera meges* can be distinguished from *curius* by the forewing discal band. Apart from the different colour of the band, green in *meges* and white in *curius*, the species can also be separated by examining the dark band outside this paler discal band. In *meges* the green band is contiguous with the dark band across the whole forewing, whereas in *curius* there is a narrow transparent band separating the white and dark bands below the forewing cell. The two species of *Lamproptera* also have other characters to separate them, particularly the white

androconial scales in the anal margin of the hindwing of the male of *curius*, which are absent in *meges*, and the green scales at the tip of the antennae of *meges*, absent in *curius*. There is also a marked difference in the tarsal claws of the two species, those of *meges* being normal, but those of *curius* having a large tooth on the lower edge of each claw. The larval foodplants of both species of *Lamproptera* are species of *Illigera* (Hernandiaceae).

### **Graphium aristeus hermocrates** (C. & R. Felder, [1865])

Dubois & de Salvaza (1919) first listed this species for Laos as ab. *aristeoides*, and in their 1921 paper they recorded both forms of the species, form *hermocrates* with a broad white discal patch on the forewing, and ab. *aristeoides* Eimer, 1899 which has the white discal patch narrower than the brown stripes on either side. Motono & Negishi (1989) recorded *aristeus* from Tha Ngone in March and April, and at Dan Sum and Tha Dua in March. They also recorded this species and *Graphium nomius*, *macareus* and *megarus* from Pakxe in July, which seems unlikely, as these species are normally single brooded and only found in the dry season. The present authors did not find any of these species during the rainy season in central and eastern Laos, and according to Wakahara (pers. comm.) these records must be erroneous, probably due to misinformation provided to Motono and Negishi by local collectors. Nishimura (1996) found five males of *aristeus* at Vang Vieng in May 1991. Osada et al. (1999) pictured a male from Nhahin and another from Vientiane, both caught in March. The present authors found *aristeus* in the lowland forest habitats at Thabok and Koun Kham valley in low numbers from February to April, but never saw it in Lak Sao.

Males of this species frequent sandy banks of streams in lowland forest during the dry season, in an extended single generation emerging from mid February to May, with most specimens found in late March and April, the hottest time of year. They sit in multi-species mud puddles without moving, with wings closed over their backs.

### **Graphium nomius swinhoi** (Moore, 1878)

Dubois & de Salvaza (1919) found *nomius* in Annam, Laos and Tonkin; and Motono & Negishi (1989) recorded it from Luang

Phrabang and Vang Vieng in March and Tha Ngone in April. Inayoshi (1996-2006) listed a specimen collected in March at Pak Xong, Champasak, southernmost Laos, and in April at Ban Nam Hom. Osada et al. (1999) illustrated a male from Saravan caught in March and a female from Thakhek collected near the end of April. They also recorded a male from Vang Vieng collected in mid May, near the end of the flight period for this species. The present authors found *nomius* to be very uncommon in the localities sampled in central Laos, recording a few specimens at Thabok in February and at Koun Kham valley in March. It was also found at Thakhek on the one, single day collecting trip the senior author made there in mid-March. The author was unable to find a suitable forest habitat to study butterflies in the area, as it was mostly deforested, and eventually found a river flowing through secondary growth with butterflies congregating on the bank. *Graphium nomius* was one of the commoner species at this locality, and it seems likely that it is more often encountered in open dry habitats than in primary forest. The senior author has also observed *nomius* to be common in such localities in northern Thailand.

*Graphium nomius* can easily be distinguished from the similar *Graphium aristeus* by the forewing submarginal spots, which are round, not linear as in *aristeus*; and the second spot from the apex is displaced towards the wing margin, whereas in *aristeus* the spots are all in line. Specimens of *Graphium nomius* are also usually larger than those of *Graphium aristeus*. Both species are often seen mud-puddling together near streams in lowland forest, and both sit stationary on the mud with wings closed and tails pointing upwards. As with other species of the *Pathysa* group of *Graphium* the female is similar to but slightly larger than the male, with more rounded forewings; and, as in other species of tribes Leptocircini and Troidini, the female lacks the androconial scent fold found in the male on the anal edge of the hindwing of almost all species.

### ***Graphium antiphates pompilius* (Fabricius, 1787)**

Dubois & de Salvaza (1919) recorded this species from Indochina, listing it occurring as two forms, f. *antiphates* and f. *pompilius*. Jordan (1909) places Tonkin [= North Vietnam] specimens under subspecies *antiphates*, and *pompilius* for Annam [= central Vietnam] and Siam [= Thailand] westward. Jordan (1909) differentiates *pompilius* from

*antiphates* thus: 'The black markings on the whole less extended than in the preceding form; very variable.' Some specimens of *pompilius* are indistinguishable from subspecies *antiphates*, but the majority have slightly narrower black bars across the forewing cell, with the second bar often not extended much past the edge of the cell into the discal region, unlike *antiphates* which normally has this bar reaching well into the discal area. Motono & Negishi (1989) list *pompilius* for central and South Laos in April, June and August. Nishimura (1996) found a male of *antiphates* at Xam Neua in April and eight males at Vang Vieng in May 1991. Osada et al. (1999) pictured a male and female from Phong Saly collected in March. The present authors found *pompilius* at every locality sampled and on almost every visit, at least in small numbers, and in February and March it was one of the commonest species seen.

*Graphium antiphates* is the commonest species of subgenus *Pathysa* in Laos, being multi-brooded, and is found both in forest, secondary growth and towns. It is found in largest numbers in February and March, but can also be seen throughout the year. Larvae can be found on *Desmos chinensis* (Annonaceae). The larvae of this species are quite distinct, early instars are pale green, with two narrow black stripes on each segment and a double row of white spots on either side of the dorsal surface. The fifth instar larva is pale green with darker green thoracic segments edged with yellow. The abdomen is marked with oblique thin green stripes, the whole surface is covered in small white spots and has a narrow white median stripe from the base of the thorax to the tip of the abdomen.

There is considerable variation in the length and width of the dark bands across the forewing cell, particularly in the fourth band, which may be very short and occasionally entirely absent. This variation led Nishimura (1996) to synonymize *itamputi* Butler, 1885 from the Malay Peninsula, Sumatra and Borneo with *pompilius*. There is also significant variation in the markings of the hindwing of *pompilius*, again in the size of the dark markings, and also in the amount of yellow in the discal area of the underside. The yellow of *pompilius* is not as rich a tone as that of *itamputi* though, and it should be noted that this colour fades in worn specimens. Jordan (1909) separates *itamputi* from *pompilius* 'by the deeper and more extended yellow distal area of the underside of the hindwing' rather than any characters of the forewing bands. We believe that *itamputi* can be regarded as a valid

subspecies (**stat. rev.**), particularly also because in most specimens of *itamputi* the black forewing margin on the upperside is shorter than in *pompilius*, not reaching vein 1b whereas in *pompilius* this band normally passes the vein and often reaches the tornal angle. The difference between *pompilius* and *itamputi* is more consistent than that between *pompilius* and nominate *antiphates*, thus *itamputi* warrants separation.

### **Graphium agetes agetes** (Westwood, 1843)

Dubois & de Salvaza (1919) first recorded *agetes* for Laos from Thado (near Nong Het), and Motono & Negishi (1989) found it at Vang Vieng in March. Nishimura (1996) found a male of *agetes* at Vang Vieng in May 1991. Inayoshi (1996-2006) also lists a specimen from Vang Vieng, caught in May; and Osada et al. (1999) pictured males from Lak Sao and a female from Phong Saly, all collected in March. The present authors found *agetes* in Koun Kham valley in small numbers between January and April and at the Vietnamese border east of Lak Sao, where it was commoner than at Koun Kham valley but with more distinct emergence, many specimens being seen at the same time. Notably *agetes* was absent from Thabok, not being seen even once on many visits.

This species is seasonally common in medium to high altitude forests, and can also be found in some lowland forest localities. It is found from January to May, but is commonest in February and March. When puddling it usually sits with wings spread in a V, similar to species of subgenus *Pazala*; unlike most other *Graphium* species, which normally sit with wings closed, except when sunning themselves in cool weather. *Graphium agetes* was only observed to sit with wings closed occasionally, particularly at midday on very hot days.

This species is not very variable, except in the width of the black bands in the forewing cell and wing margins. The third band occasionally does not fully cross the cell, and some specimens have wider black margins to the wings.

### **Graphium eurous inthanon** Katayama, 1986

*Graphium eurous* has been recorded from various mountains across north and central Laos, from the Thai to Vietnamese borders

flying in a single brood between late January and April, dependent on altitude. The first records were relatively recent, after Prasobsuk Sukkit crossed the border from Nan Province, Thailand to collect butterflies at Doi Pee Ban Nam, Xaignabouri in February 1990 (Nishimura 1996; Inayoshi 1996-2006). Osada et al. (1999) pictured two males from Lak Sao caught on 1<sup>st</sup> February 1997. The authors occasionally found this species near the Vietnamese border at Lak Sao in January and February, but it was not common. It can be found near Lak Sao at altitudes as low as 550 metres but is commoner in high mountains where it emerges slightly later as altitude increases. The senior author obtained specimens from Khamboun SP collected in February, March and April at between 800 and 2000 metres on Phou Phan, Xam Neua. The male will mud-puddle near streams, where it will investigate the banks with a skipping flight pattern before alighting to drink, sitting with wings held open in a V, similar to *Graphium agetes*. Wakahara (pers. comm.) found *eurous* south of Lak Sao in early February and also confirms the presence of this species across northern and central Laos. He also stated that females of this species are sometimes found drinking water near streams like the males. There does not seem to be any significant difference between Lao specimens of *eurous* and those from northern Thailand.

***Graphium mandarinus kimurai* Murayama, 1982**

Osada et al. (1999) recorded this species in their checklist without any additional information or photograph. The senior author met Osada in the forest at Koun Kham in February 2006, and Osada explained that the species had been reported to him as present in Xaignabouri Province in January, but that he had not actually seen any specimens himself. It is very likely that this species does occur on Doi Pee Ban Nam, Xaignabouri Province. This mountain is near the Thai border, where this species is known to fly on adjacent, and faunistically similar, Doi Phu Kha, Nan Province. In Thailand *Graphium mandarinus* is univoltine, flying in January before *Graphium eurous*, but in China and North Vietnam it appears to have a second generation in July. Yutaka Inayoshi (pers. comm.) recently sent photographs of *Graphium mandarinus* from Hagiang, North Vietnam collected in July, and the senior author obtained a series of specimens from Sapa and Hagiang collected in April and

May 2006. There is significant difference between specimens from the two localities in Vietnam, despite their being near each other; notably they are separated by the Hồng river valley. Such local variation is also observed within Chiang Mai Province, Thailand, where the slightly different subspecies *kimurai* and *fangana* are separated by only 100 km. Wakahara (pers. comm.) has found this species on Phou Bia at 1250 metres in February, and kindly provided the senior author with four specimens. These specimens are similar to those from Hagiang and Sapa, but not identical to specimens from either locality. The authors tentatively include the Lao specimens in subspecies *kimurai* for the present, until more specimens become available from across Laos.

**Graphium mullah kooichii** (Morita, 1996) **comb. nov.**

Morita (1996) first recorded this species in Laos when he described this subspecies in genus *Pazala*, which the present authors regard as a subgenus of *Graphium*. Osada et al. (1999) pictured two males and a female collected in March 1997. The senior author also found *kooichii* at the type locality near the Vietnamese border east of Lak Sao in early March 2005 and mid February to early March 2006, not recording it at any other time or place.

The authors have examined photographs of the two syntypes of *mullah* (Alphéraky, 1897) in St. Petersburg provided by Vadim Tshikolovets of the Kiev Museum. It is clear that the nominal taxa *mullah* and *timur* (Ney, 1911) are conspecific (**syn. nov.**), and as *mullah* is the senior synonym it becomes the correct name for this species. As the types of both *mullah* and *timur* come from Sichuan the nominate subspecies, *Graphium mullah mullah* (Alphéraky, 1897) therefore applies to the Sichuan population. The Taiwanese subspecies thus becomes *Graphium mullah chungianus* (Murayama, 1961) **comb. nov.**, and the Lao subspecies *Graphium mullah kooichii* (Morita, 1996) **comb. nov.** Campbell Smith (pers. comm.) of the Natural History Museum, London, independently came to the same conclusion, having also examined photographs of the types of *mullah* for his ongoing studies on *Pazala* species. He kindly recommended the authors publish the synonymy in this paper.

This species has so far been found in Laos around the type locality of *kooichii*, east of Lak Sao, but probably also can be found at other

locations in the hills on the Vietnamese border. Wakahara (pers. comm.) also reports its presence on Phou Phan, Xam Neua in March, but the authors have not seen any specimens from there. Its flight period is very short; the senior author found several fresh specimens in the second week of March 2005, but on a subsequent visit later in the month no specimens were seen, not even worn ones. It seems the emergence date of this species varies somewhat from year to year, as Osada et al. (1999) recorded fresh males on 14<sup>th</sup> March 1997. The first fresh specimen of 2006 was seen on 16<sup>th</sup> February, but on the next visit in early March the few specimens seen were old.

*Graphium mullah* has a skipping flight, usually being seen between 11 and 12 o'clock at the type locality at 660 m above sea level. It will investigate the riverside before eventually stopping to mud-puddle, sitting on the ground with wings stationary in a V posture. The only specimen encountered at a lower elevation, 100 metres below the type locality, was seen at 10 am, possibly because it is considerably warmer at this altitude.

### **Graphium phidias** (Oberthür, 1906)

In a previous paper (Cotton & Racheli 2006) the authors synonymized *akikoe* with *phidias*. Morita & Shinkai (1996) described *akikoe* from Lak Sao, but the cited differences from Vietnamese specimens fall within the general variability of the species. The name *Papilio phidias* Oberthür, 1906 is a homonym of *Papilio phidias* Linnaeus, 1758 and *Papilio phidias* Cramer, 1779. As both senior names apply to species of Hesperidae, and have not been considered congeneric with *Papilio phidias* Oberthür since 1899, according to the ICZN Code (ICZN 2000) the name *phidias* Oberthür must continue to be used pending a decision of the ICZN Commission.

*Graphium phidias* occurs only in the range of hills on the Vietnamese border, being known to the authors from Xam Neua and Lak Sao areas. Dubois & de Salvaza (1921) did not record this species as present in Laos, listing it only from Annam. Osada et al. (1999) pictured four males from Lak Sao collected in February and a female from near the top of the mountain on the border with Vietnam (Osada pers. comm.), collected in March 1998. The senior author found *phidias* to be quite common near the border east of Lak Sao at the type locality of *akikoe* in the second half of February,

and Khamboun SP provided some specimens from Phou Phan, Xam Neua, caught in March. Wakahara (pers. comm.) has found *phidias* only in these localities, and about 50 km northeast of Lak Sao, and reports that the female can only be found at higher altitudes than the male. Wakahara (pers. comm.) reports that on Phou Phan, Xam Neua, the male is commonly found at 1200 m in March, but very few females have ever been found, at 1600 m, where the foodplant grows. Wakahara also informed the authors that *phidias* is only found on mountains with outcrops of basement metamorphic rock. There is only one generation per year, in February at lower elevations (6-700 m) and in March to April at higher elevations. The flight period is very short; most specimens at a particular locality emerging within a few days of each other, and two weeks later only a few worn specimens may be encountered. It appears to mimic the sympatric *Parantica melaneus* (Danainae), looking very similar in flight, although it moves faster than the *Parantica*. When mud-puddling *phidias* either sits with wings angled in a V or beats its forewings as it drinks, unlike the Danaine model which sits with its wings closed. *Graphium phidias* is a rather nervous species, flying away at the slightest disturbance. Wakahara (pers. comm.) reports that when caught *phidias* may behave like a bee, bending the abdomen as if to sting, and sometimes also pretends to be dead.

*Graphium phidias* has traditionally been placed in subgenus *Paranticopsis* along with the next three species, since it has a similar basic pattern mimetic of the Danainae genus *Parantica*. There are some characters, such as the double row of submarginal spots of the forewing, thin tails (*phidias* is the only tailed species of this group) and the pale bands in the forewing cell running across the cell rather than diagonally along it, which indicate it is likely that this pattern is convergent or plesiomorphic, and *phidias* may actually not be closely related to true *Paranticopsis*.

### ***Graphium xenocles lindos* (Fruhstorfer, 1902)**

Dubois & de Salvaza (1919) recorded this species from Laos as form *xenocles*, which comes from Assam, as opposed to *kephisos* which they restricted to Tonkin. Motono & Negishi (1989) treated *Graphium xenocles* from Laos as subspecies *kephisos*, and found it at Vang Vieng in March, Vientiane in May, and Tha Ngone in July.

Inayoshi (1996-2006) recorded *lindos* from Champasak in March and *kephisos* from Thabok in April, and Osada et al. (1999) illustrated males from Thabok and Phong Saly caught in March and a male-like female from Oudomxay, northern Laos collected on 2<sup>nd</sup> May 1995, all of which they referred to subspecies *kephisos*. The present authors found *xenocles* to be one of the commonest *Graphium* species at Thabok and Hinboun District, and slightly less common than *sarpedon* and *chironides* in Lak Sao, where it started to emerge in March, as opposed to late January and February at the former localities. The senior author also found several females at Thabok and Koun Kham valley, feeding on flowering shrubs in the forest, both male-like and exhibiting various degrees of melanism.

Fruhstorfer (1902b) described *kephisos* (type locality Chiem Hoa, Tonkin) and *lindos* (type locality Muok-Lek, 1000', Siam [in eastern Saraburi Province, Thailand]) in the same paper. Jordan (1909) gave the distribution of subspecies *kephisos* as 'Burma, Tenasserim, Shan States, Tonkin', and that of *lindos* as 'Siam'. Pinratana (1977) and Pinratana & Eliot, 1992 used the name *lindos* to refer to specimens from Chanthaburi Province, southeastern Thailand, and *kephisos* for the population from the western side of the Country. Inayoshi (1996-2006) recorded both subspecies *kephisos* and *lindos* as occurring in Laos, *kephisos* from most of the country and *lindos* from the far south. The specimen from Champasak, southern Laos pictured by Inayoshi (1996-2006) as *lindos* is typical of the variation of *xenocles* in the Mekong and Chao Phrya River basins of Laos and Thailand respectively. Having examined the types of *kephisos* Fruhstorfer, 1902 and *lindos* Fruhstorfer, 1902 as well as a large number of specimens from Laos, Thailand, Cambodia and Vietnam, the authors conclude that *kephisos* and *lindos* do constitute distinct subspecies, but that true *kephisos* is not present in Thailand. The populations of Thailand, whether in the north, northeast or west of that country are all referable to subspecies *lindos* as delineated by Fruhstorfer's type. The population in the Cardamom Mountains in Southeast Thailand, which Pinratana (1977) separated as *lindos*, and also occurs in southern Cambodia and southern Vietnam, may prove to be distinct from *xenocles* from the rest of Indochina. Further investigation is necessary before proposing a new name for that population. The present authors restrict subspecies *kephisos* to northern Vietnam, the specimens from that part of the country being very consistent

in phenotype; the hindwing of all specimens seen has a broad dark margin to the upperside and shorter pale discal stripes than the much more variable *lindos*. The known females of *kephisos* are all male-like, not dark like many females of *lindos*. The distribution of subspecies *kephisos* in China is unknown, but this subspecies almost certainly occurs in southern Yunnan, as the senior author has a series of specimens referable to *kephisos* from Emei Shan, Sichuan in his collection.

The authors have seen several hundred specimens of *xenocles* from central Laos; of these the majority are typical of subspecies *lindos*, with pale stripes almost filling the hindwing spaces, but a few approach the *kephisos* phenotype. The only specimens seen from northern Laos are two specimens in the senior author's collection from Phou Phan, Xam Neua, which are both similar to *kephisos*, as is the male from Phong Saly and female from Oudomxay pictured by Osada et al. (1999). Until such time as more specimens from northern Laos become available for study the present authors prefer to regard *xenocles* from the whole of Laos as belonging to subspecies *lindos*.

*Graphium xenocles* can be distinguished from the similar species *macareus* by the presence of an orange-yellow spot on the anal angle of the hindwing, and its usually larger size. *Graphium xenocles lindos* is extremely variable in the extent of the pale markings on both pairs of wings. Some specimens have reduced pale stripes, and some have enlarged ones, especially on the hindwings, sometimes to the extent that the discal stripes fuse with the submarginal spots. Females, which are larger than males, vary in pattern from light to dark. Light specimens are somewhat darker than the male, with reduced pale stripes, especially on the forewing; and dark examples have some pale submarginal spots on the forewing and reduced markings on the hindwings. Darker females of this subspecies are difficult to distinguish from sympatric females of *Graphium macareus*, as some lack the 'characteristic' yellow hindwing spot. The dark females of both species mimic various *Euploea* (Nymphalidae: Danainae), and *xenocles* can often only be separated from *macareus* by its larger size and slightly more elongate wing shape. Indeed, some females of *macareus* have a few yellow scales at the hindwing tornus also.

*Graphium xenocles* is the only species of the mimetic subgenus *Paranticopsis* which flies throughout the year. All the other species in this group found in Laos only fly in the dry season up until the

early rainy season. It is commonest in February and March, when males can be found puddling in large numbers in lowland forest, but occurs in lower numbers throughout the year. Females may be found flying around flowering shrubs and trees. Both sexes exhibit a flight pattern similar to the *Danainae* models which they mimic, slow and seemingly unafraid; but, unlike the models, will fly away quickly if disturbed. Males of *xenocles* will beat their forewings while puddling, unlike *macareus* and *megarus*, which sit on the mud with wings closed.

### **Graphium macareus indochinensis** (Fruhstorfer, 1901)

Fruhstorfer (1901) described *indochinensis* from Burma, Siam, Tonkin and Annam, naming two forms, normal *indochinensis* and a form with enlarged white stripes on the hindwings, such that the discal and submarginal spots fuse together, which he called *argentifera*. He later (Fruhstorfer, [1903]) stated that the type came from Tonkin. Dubois & de Salvaza (1919) recorded *macareus* from Laos as form *lioneli*, the name proposed by Fruhstorfer (1902e) to separate Assamese *macareus* from subspecies *indicus* Rothschild, 1895, described from Sikkim. Motono & Negishi (1989) list *macareus* from Dan Sum in February and March, Tha Ngone and Vang Vieng in March and Pakxe in May and supposedly July, which is doubtful (see above under *Graphium aristeus*). Inayoshi (1996-2006) recorded a male of *indochinensis* from Hongsa, Xaignabouri Province, collected by Prasobsuk Sukkit in May 1989; a male caught by Nishimura at Vang Vieng in May 1991; and 11 males from Pak Xong, Champasak caught by Inayoshi on 25<sup>th</sup> March 1996. He also recorded a female collected by Nishimura at Ban Lao, Thakhek on 24<sup>th</sup> March 1995. This specimen was found while Nishimura was catching *Atrophaneura laos* at flowers (Inayoshi, pers. comm.). Osada et al. (1999) pictured a normal male from Lak Sao caught in March and a male of form *argentifera* from Vang Vieng collected at the beginning of June; as well as a male-like female from Oudomxay caught at the end of March and a dark female from Xiang Khouang collected in early April.

The authors found *macareus* at all the localities surveyed across central Laos, finding it in Thabok between February and April, at Hinboun District from February to May, and near the border at Lak Sao in March and April. This species is widespread in lowland forests

in Laos, flying only during the dry season from February until the start of the rainy season in May. It may be common in some years, or rare in other years, but is generally much rarer than *xenocles*. Form *argentifera* is much rarer than the normal form, and is found occasionally amongst mud-puddling specimens of form *indochinensis*. The female has three forms, a form identical to a normal male; a form with dark forewings and white stripes on the hindwings; and a form with dark forewings and reduced spots on the hindwings. Both sexes are mimetic of *Parantica* or *Euploea* species, which are common in lowland forests in Laos.

### **Graphium megarus megapenthes** (Fruhstorfer, 1902)

Dubois & de Salvaza (1919) listed *megarus* for Indochina as *similis* Lathy, 1899, but that name is a homonym, so *megapenthes* Fruhstorfer is the correct name for this subspecies. Motoshi & Negishi found this species at Pakxe and Luang Phrabang in March and at Tha Ngone in April. Inayoshi (1996-2006) recorded a male at Thabok in early April and 7 males in Pak Xong, Champasak on 25<sup>th</sup> March 1996. Osada et al. (1999) pictured a male from Thabok, and two females from Thateng, southern Laos, all caught in March. The present authors found *megarus* between January and April at Thabok and Hinboun District, but did not see it in Lak Sao.

This is the smallest species in subgenus *Paranticopsis*; and it resembles very small specimens of the common Danainae species *Tirumala septentrionis* rather than *Parantica*, due to the stripes of fresh specimens being pale blue, not white. *Graphium megarus* may also be easily distinguished from *macareus* by the discal band of spots of the hindwing being composed of a double row of spots, not a single row of elongate bars as in *macareus*. This species flies in the dry season, and is common in late February and early March, and again in April. Males mud-puddle on banks of streams in lowland forest, often gathering in some numbers together with *xenocles* and *macareus* as well as other Papilionids. Females may often be found near flowering shrubs in lowland forest and also in secondary growth near the forest. The female of this species looks like the male, but occasional dark specimens with reduced markings on the forewings may be found in both sexes.

### **Graphium arycles sphinx** (Fruhstorfer, 1899)

Fruhstorfer described *sphinx* in two papers in 1899 from a single male supposedly of unknown locality. The first paper (Fruhstorfer 1899a), contained a description only, and the second (Fruhstorfer 1899b), repeated the description and also illustrated the type. Two males with type labels in the NHM, London, bear a Fruhstorfer locality label 'Indochina', and there is a third female specimen with a type label, from Cochinchina. Obviously the female specimen is not the true type of *sphinx*, as it was described from a male. The male in the type collection can also be discounted, as it has red spots on the underside of the hindwings, unlike the type, which Fruhstorfer stated had yellow spots instead of red. The remaining specimen in the NHM collection labelled Indochina has such yellow spots, and bears a round BMNH paratype label, added at the outset of the Second World War. This specimen agrees with the description of the type and with the specimen pictured by Fruhstorfer, and must be the true holotype of *sphinx*. Fruhstorfer [1902c] described *Papilio arycles arycleoides* from Muok-Lek, Siam, and discussed *sphinx* further, suggesting that the type probably came from Tonkin. Doubtless Fruhstorfer added the 'Indochina' locality label after describing *sphinx*, having realised where the approximate origin of the specimen was. He stated that *arycleoides* and *sphinx* both have blue-green colouration, rather than the green of *arycles*, but that *sphinx* has yellow spots on the hindwing underside and *arycleoides* red ones. He also commented on the occurrence of yellow spotted specimens of subspecies *arycles*. Indeed, such specimens are occasionally found among the normal red-spotted specimens of this and several other closely related *Graphium* species. This is genetically induced by a mutation in the genes controlling production of red pigment. Mutant specimens have all the red pigment replaced by yellow. Muok-Lek, the type locality of *arycleoides*, is in eastern Saraburi Province, Thailand, and was a wet malarial forest when Fruhstorfer was there, but nowadays the habitat has been destroyed. This locality is not very far south of Laos, and the species is found in suitable habitats around northeastern Thailand, as the foodplant, *Melodorum fruticosum* (Annonaceae), also grows in dry forest. Examination of the types of *sphinx* and *arycleoides* shows no notable differences. The nominate subspecies from the Malay Peninsula is obviously different, being slightly smaller, and apple

green spotted, rather than blue. It should be noted that these colour differences are only obvious in fresher specimens, as the bright colours fade within a relatively short time, even when kept in the dark. Thus it is clear that *arycleoides* Fruhstorfer, [1902] is a junior synonym of *sphinx* Fruhstorfer, 1899 (**syn. nov.**), and the type locality of *sphinx* should be regarded as 'Indochina'.

Dubois & de Salvaza (1921) listed *arycles* from Laos, without exact locality, and Motono & Negishi (1989), using the name *arycleoides*, recorded it in Vientiane in July, and Tha Ngone and Nam Ngum Dam in August. Inayoshi (1999-2006) found it at Vang Vieng in June, and Osada et al. (1999) pictured males from Thabok collected in March and September, and a female caught in March at Phong Si, which is south of Pak Kading between Thabok and the junction of Highway 8 to Lak Sao. The present authors found *arycles* from February to August at Thabok and Hinboun District, and saw a few specimens in Lak Sao in March.

This subspecies is found in lowland forest, both evergreen and dry, from central Laos southwards to eastern Thailand, Cambodia and Vietnam. It tends to be somewhat local in occurrence, but can be common when in season. It can be found several times through the year, particularly in late February and March and again in the rainy season.

The senior author found an unusual aberration in Thabok on 9<sup>th</sup> August 2005. All the blue spots on the upperside of this example were dull olive green, despite it being a fresh specimen. The senior author has only ever found one yellow spotted specimen in Laos, at Tad Nam Sanam, Koun Kham Valley.

### **Graphium chironides chironides** (Honrath, 1884)

The taxon now known as *chironides* was previously known as *Graphium bathycles chiron*, but was separated at species level by Saigusa et al. (1977), who showed that the taxa *chiron* and *bathycloides* are sympatric in the northern Malay Peninsula, and have distinct differences in the male genitalia. Eliot (1982) pointed out that the name *chiron* Wallace, 1865 is a homonym and elevated *clanis* Jordan, 1909 as the species name, proposed *chironicum* as a replacement name for *chiron* and *malayanum* as the name for the subspecies found in the Malay Peninsula. After being informed of his

error by Racheli, Eliot (1983) stated his oversight of the earlier name *chironides* Honrath, 1884, correcting the species name to *chironides* and sinking *chironicum* as a synonym.

This species is easily distinguished from similar species in Laos by the orange, rather than red spots on the hindwing underside. In fresh specimens the spots on the upperside of the forewing are blue, except those between the cell and wing tip, which are greenish. This colour difference fades quickly, not being obvious in worn specimens. Indeed, the blue-green coloration of *eurypylus* group *Graphium* species soon fades in collections, and the differing blue tones of fresh specimens of the various species in the group are not apparent in museum specimens.

Dubois & de Salvaza (1919) listed this species in Indochina as *Papilio bathycles* f. *chiron*, and in their 1921 paper also listed f. *ligyra* Jordan, 1909, which was described as the spring form of *chiron*. Motono & Negishi (1989) recorded *Graphium chiron* from Vang Vieng in March and October, and Osada et al. (1999) pictured two males from Lak Sao caught in March and a male from Phong Saly caught at the end of August. Tcherniak & Tuzov (2003) listed *Graphium bathycles bathycloides* as a new record for Laos, claiming to have found it at Lak Sao, but this must have been a misidentification of *chironides*, as *bathycles* is not found north of the Isthmus of Kra. The present authors found *chironides* on each visit at all localities investigated, but it was more numerous at higher altitudes.

*Graphium chironides* is found in forests across Laos throughout the year, both in the lowlands, where it is found with many other *Graphium* species and at higher altitudes where it is the only common representative of the *eurypylus* group. At altitudes of over 600 metres *chironides* is the commonest species, and at higher altitudes is normally the only species of this group seen, flying with *Graphium sarpedon*.

Dry season specimens tend to be smaller and paler (form *ligyra* Jordan, 1909), but normal specimens can also be found flying with f. *ligyra*. Melanic specimens have been found rarely, with black scales obliterating the blue-green patches of the discal area of the forewings. The senior author found one such individual near the Vietnamese border east of Lak Sao in April 2006.

### **Graphium eurypylus cheronus** (Fruhstorfer, [1903])

Dubois & de Salvaza (1919) listed *eurypylus* from Indochina, and Motono & Negishi (1989) found it at Luang Phrabang in August. Osada et al. (1999) illustrated two males from Vang Vieng caught in March and July and a further male from Lak Sao collected on 30<sup>th</sup> April 1995. They also pictured a female from Xiang Khouang, collected in August, which the present authors believe likely to actually be a female of *Graphium evemon*. The present authors found *eurypylus* across the localities sampled in at least small numbers on each trip, but the species was noticeably commoner in 2006 than in the previous year. This species is generally rare, being found across the country in small numbers throughout the year, but with peaks in numbers in late February to mid March and again in mid April, when it can be quite common in lowland evergreen forest. It is always less numerous than *Graphium doson*, with which it can be seen mud-puddling near streams, and is distinguished from this very similar species by the black bar holding the red spot in S8 on the underside of the hindwing joining the black anal submarginal stripe near the base of the cell in a Y. In *Graphium doson* this black bar is clearly separate from the black submarginal stripe. In some specimens of *eurypylus cheronus* the two black patches do not quite meet, but these specimens are distinguished from *doson axion* by the presence of a 'teardrop' lobe on the pale blue discal band in space 6 on both sides of the hindwing, immediately above the centre of the cell.

### **Graphium doson axion** (C. & R. Felder, 1864)

Dubois & de Salvaza (1919) found *doson* across Indochina, and Motono & Negishi (1989) recorded it from localities across the country in May, July and August. Inayoshi (1996-2006) listed specimens caught at Hongsa in May 1989 and at Pak Xong, Champasak in March. Osada et al. (1999) pictured males from Thabok, Lak Sao and Saravan, all caught in March. The present authors found this species at every locality visited, and often in large numbers.

This is the commonest *Graphium* species in this group, and subspecies *axion* is found across mainland Asia, from northern India to China, Indochina and Thailand. It is replaced in the Malay Peninsula by subspecies *evemonides*. *Graphium doson axion* can be

found throughout the year in Laos, but is rarer in the winter than the rest of the year. This species exploits many habitats, even being found in towns, but is commonest in lowland evergreen forest, where males can be seen flying along paths and streams, and puddling in large numbers, often outnumbering all other *Graphium* species together in a multi-species group. If disturbed when puddling members of this species will fly up and down the stream in a ribbon, as if playing 'follow the leader', near the place they were puddling, before eventually returning to the mud to continue drinking. Males of this and related *Graphium* species are all attracted to anything bright blue, often investigating any such coloured object on the ground, including PVC piping, plastic bags or drink cartons.

Some aberrations have been noted in this species, particularly fusion of spots in the forewing cell, and very rarely specimens are found with the red marks replaced by yellow.

### ***Graphium evemon albociliatis* (Fruhstorfer, 1901)**

Fruhstorfer (1901) described this subspecies of *Graphium evemon* from Tonkin, Chiem Hoa, and when describing *evemon eventus* Fruhstorfer (1908a), listed it as a separate species, presumably due to the presence of a red spot in S8 near the costa on the underside of the hindwing, which is absent in the other subspecies of *evemon*. Jordan (1909) showed *albociliatis* to be conspecific with *evemon* based on examination of genitalia and androconia; and confirmed the correct spelling as *albociliatis*, placing *albociliatus*, the alternative spelling used by Fruhstorfer subsequent to the original description, in synonymy.

The senior author was the first person to find this species in Laos east of Lak Sao in March 2005, as recorded in Cotton & Racheli (2006). Previous authors, such as Osada et al. (1999), probably mistook specimens of this species for the very similar *Graphium eurypylus*, as all other subspecies of *Graphium evemon* lack the red spot in the dark bar near the base of the hindwing underside, which character is used to distinguish *evemon* from *eurypylus* in the Sundaland region. *Graphium evemon albociliatis* male can be most easily distinguished from *eurypylus cheronus* by the absence of the last submarginal spot in S2 on the forewing upperside. In *eurypylus* there are a total of nine spots in the submarginal band, whereas in *evemon* there are only

eight. Also the androconial scales in the anal fold of the hindwing of the two species are quite different. In *evemon* the long hairs in the edge of the fold are white, sparser and shorter than in *eurypylus*, which has longer yellow hairs. The short androconial scales beneath the hairs are much more numerous in *eurypylus*, and spread in a patch across the centre of the anal fold. In *evemon* the short scales are only found along the anal edge, and are also paler in colour. On the forewing, the basal two of the four stripes in the cell are usually fainter in *evemon*. At present there is not enough material available to definitely separate the females of *evemon* and *eurypylus*, but if the same pattern characters apply for the female, the specimen figured by Osada et al. (1999) collected at Xiang Khouang on 26<sup>th</sup> August 1994 is almost certainly *evemon*, not *eurypylus*.

*Graphium evemon albociliatis* emerges in mid March, not being seen earlier in the year. This is in contrast with *evemon eventus*, which is found at its northernmost known habitat in Ranong, South Thailand in January. In March 2006 this species was also found at Koun Kham valley, unlike in 2005 when it was only seen near the Vietnamese border. It is notable that *Graphium eurypylus* was also much more common in March 2006 than the year before. *Graphium eurypylus* emerges in numbers in March, and the rarer *evemon* can be seen puddling in mixed groups with *sarpedon*, *doson*, *chironides*, *eurypylus* and *arycles*. *Graphium evemon* can usually be distinguished from *eurypylus* when puddling by its paler silvery blue discal markings on the underside. It is probable that this species is distributed more widely within Laos, as *evemon albociliatis* is also found in Assam and Burma, as well as Vietnam, and probably Yunnan. It has not been recorded from Thailand, despite being known from nearby Kalaw, Shan States.

### **Graphium agamemnon agamemnon** (Linnaeus, 1758)

Dubois & de Salvaza (1919) listed *agamemnon* (sic!) for Indochina, correcting the spelling to *agamemnon* in their 1921 paper. In both papers they also listed ab. *aegisthus* Linnaeus, 1763, which Jordan (1909) refers to specimens with very short stumps instead of distinct tails. Motono & Negishi (1989) found *agamemnon* in Pakxe in February and May, at Tha Ngone in May and September, Nam Ngum Dam in August, Vientiane in September, and Hat Pho in November.

Osada et al. (1999) pictured a male from Thabok collected in March and a female from Luang Phrabang caught at the end of July. Nimura & Wakahara (2005) also recorded this species in the winter, finding a male and four females between late November and early January at Nam Dhua. The present authors found *agamemnon* in Thabok and Hinboun District on all visits, and recorded it at Lak Sao from March to July.

This bright green spotted species is common throughout Laos, both in forests and towns, due to its ability to utilize many different larval foodplants in families Annonaceae and Magnoliaceae. It can generally be seen throughout the year, at least in small numbers, and is sometimes very common. When mud-puddling it tends to keep moving, rather than sitting stationary on the mud, and will continually move around the muddy bank, feeding for a few seconds before moving a few inches away to suck more moisture from the ground. Females are similar in appearance to the male but have longer tails on the hindwings. They can often be observed feeding at flowers, but are otherwise hard to find, usually flying in the canopy.

This species is not very variable, although melanic specimens have been found extremely rarely. Fresh males have a red hue to the underside, but this colour fades soon after emergence.

### **Graphium cloanthus cloanthus** (Westwood, 1841)

In Laos this species is confined to higher mountains of the northern and central areas. It is significant that in two years studying Lao butterflies in the forest the senior author never once saw this species, due to the study area being just too far south of its range. Dubois & de Salvaza (1919) recorded *cloanthus* from Thado, and Osada et al. (1999) pictured a male from Xam Neua caught in May and a female from the same locality collected in October. Khamboun SP provided the senior author with a series of specimens from Phou Phan, Xam Neua, collected between February and June. As with other species of subgenus *Graphium*, the female is similar to the male, but lacks the androconial fold on the hindwing. Wakahara (pers. comm.) reports it from 1200 m upwards on Phou Bia and commonly found on Phou Phan, Xam Neua, puddling at 1360 m.

**Graphium sarpedon sarpedon** (Linnaeus, 1758)

Dubois & de Salvaza (1919) recorded *sarpedon* from Laos as f. *teredon*, which is the name for the South Indian subspecies with an elongate hindwing. Motono & Negishi (1989) recorded *sarpedon* from Vientiane in July and from Luang Phrabang from August to November. Inayoshi (1996-2006) lists specimens from Ponsavan, Xiang Khouang collected in June, and from Pak Xong, Champasak caught in March, as well as a female caught by Nishimura on 24<sup>th</sup> March 1995 at Thakhek. Osada et al. (1999) pictured four males from Lak Sao, one specimen collected in March with broad green discal band is typical of dry season specimens, and a second caught in September is the rainy season form, which has a narrower discal band. The other two specimens collected in March are aberrations, one with a green patch in the forewing cell and the other is semi-melanic, with black scales peppering the green discal band. Nimura & Wakahara (2005) found two males of *sarpedon* at Thabok in late December.

This is one of the commonest and most widespread forest species of *Graphium*, being found throughout forested areas over the whole country, both in lowlands and high montane habitats, but is not usually seen in towns and cultivated areas. *Graphium sarpedon* is often the first species of Papilionid to be seen mud-puddling in the morning, and also the last in the afternoon. It can be seen throughout the year, at least in small numbers, but when a brood emerges there are often very many specimens mud-puddling at any one time. The larval foodplant is *Cinnamomum*. Wakahara (pers. comm.) told the senior author that *sarpedon* prefers a small leafed species to the large leafed one also found in the forest.

The species can be considerably variable in pattern, especially in eastern Laos, where specimens often have a reduced blue-green hindwing band, broken into individual spots. Often specimens are seen with a green patch of variable size inside the forewing cell, and very occasional melanic specimens have been found, entirely black except for the small blue spot at the tip of the forewing, and the submarginal lunules on the hindwings. The senior author caught one such specimen 6 km from the Vietnamese border east of Lak Sao in March 2005. Very rarely specimens have been seen where the red pigment is replaced by yellow.

## ***Teinopalpus imperialis imperatrix* de Nicéville, 1899**

*Teinopalpus imperialis* was first recorded from Laos when Turlin (1991) described subspecies *gillesi* from a single male caught '20 km SW of Sam Neua, Laos'. This locality is the 2000 metre high mountain previously referred to in this paper as Phou Phan, Xam Neua. Osada et al. (1999) published photographs of two males from Xam Neua caught in April and at the end of May, and the first published picture of a female from Laos, collected on 19<sup>th</sup> August 1997 at the same locality.

The following three subspecies, *bhumipoli* Nakano & Sukkit, 1985 (type locality Chiang Mai, Thailand), *gerritesi* Nakano, 1995 (type locality Nan, N. E. Thailand) and *gillesi* Turlin, 1991 (type locality 20 km SW of Xam Neua, Laos) were all described from a limited number of specimens, and in the case of *gillesi* Turlin, 1991, from a single male. 15 males and 4 females of Burmese *imperatrix* de Nicéville, 1899 (type locality Toungoo Hills, Burma) were examined in the Natural History Museum, London; many specimens of *bhumipoli* in various collections; a large series of specimens of *gillesi* from the type locality in the collection of Khamboun SP, 25 males and 12 females from N. Vietnam (recorded there as subspecies *gillesi* by Shinkai, 1999), the male holotype of *gillesi* in MNHN, Paris, examined by the junior author, and photographs of the holotype of *gillesi* provided to the senior author by Christoph Häuser of the GART project, Stuttgart. Inayoshi (1996-2006) has examined six males from Nan, illustrating two, and places these and the specimens from Chiang Mai under *imperatrix*. He also pictures three of the four females from Chiang Mai that he has seen. Schäffler (2004) described as new subspecies *hakkaorum* from Lianhua Shan, Guangdong, southern China, comparing his specimens solely with subspecies *behludinii* Pen, 1937 from Sichuan, rather than with *imperatrix*, *bhumipoli*, *gerritesi* or *gillesi*. Examination of the excellent plates which show both fasciae of the holotype, two male paratypes and three female paratypes show clearly that this subspecies is also identical to *imperatrix*. This is not surprising, since the mountains in Guangdong are the eastward extension of the same range as in northern Vietnam. The most obvious differences between the subspecies of *imperialis* can be seen in the females, and all the females examined by the present authors were similar to those from Southern Burma, with enlarged yellow patch near the anal area of the hindwing, compared with the nominate subspecies, which has

only a small yellow mark. Specimens from the above localities all fall within the variability of subspecies *imperatrix*, and thus *bhumipoli*, *gerritesi*, *gillesi*, and *hakkaorum* should all be regarded as synonyms of *imperatrix* de Nicéville, 1899, **syn. nov.** Thus *imperatrix* is the southernmost subspecies of *Teinopalpus imperialis*, distributed across the hills of Southern Burma through northern Thailand and Laos to North Vietnam and southern China.

Wakahara (pers. comm.) confirmed the presence of *Teinopalpus imperialis* on many high mountains across northern Laos at altitudes of about 1800 m, and agrees that they are all referable to subspecies *imperatrix*. Wakahara states that the species flies in three overlapping generations, starting in February and flying through the year until November. Fresh specimens of both sexes can be found drinking water in the morning, but fly in the canopy after midday. He also reports that males are attracted to dark green and blue objects, and that females can be seen flying around the foodplant, a common highland species of *Magnolia*.

Shirou Sugimoto (pers. comm.) confirms the male is attracted to dark green objects, and that freshly emerged males can be found mud-puddling in the morning between 8 and 12 o'clock.

### ***Teinopalpus aureus shinkaii* Morita, 1998**

Masui & Uehara (2000) first recorded the presence of *Teinopalpus aureus* in Xam Neua, N. E. Laos. The authors have not seen any specimens of this elusive species from Laos except the photograph of a male in the above paper, and are hesitant to draw any conclusions as to the validity of the various described subspecies until such time as sufficient material is available for study. The authors presently place Lao material under subspecies *shinkaii* described from Mt. Pia Oac, 1911 m, North Vietnam by Morita (1998).

This butterfly has been found rarely in March and April (Khamboun SP, pers. comm.) from the summit of Phou Phan, Xam Neua, at 2000 metres above sea level. Shirou Sugimoto (pers. comm.) says the male flies near the ground only at dawn on Phou Phan, the rest of the day flying in the canopy. Shinkai (1999), reporting on this taxon in Mt. Pia Oac, north Vietnam, states that there are two generations per year. The first generation flies between the end of March and May, and the second generation flies from late July to

September. The spring form has thinner tails and a larger yellow hindwing patch than the summer form. The male forewing is darker green than Chinese subspecies and subspecies *shinkaii* is of larger size, especially the female, which is very big. It is noteworthy that both species of *Teinopalpus* are sympatric on Phou Phan, as the ranges of the two species overlap in northeastern Laos and north Vietnam, but they are only known to occur together in Vietnam on Mt. Pia Oac according to Igarashi (2000), who described the early stages of *aureus* from Tam Dao. Uehara & Masui (2002) discussed and illustrated a natural hybrid male between *aureus* and *imperialis* from Xam Neua found among specimens of *imperialis* examined. This specimen is intermediate between the two species, and its occurrence indicates the close affinity between them.

Wakahara (pers. comm.) has also found this species on Phou Sankom at 1850 m, a limestone mountain 90 km southeast of Xam Neua, and on the Vietnamese border east of Sop Bao. He believes this species is only found on limestone, or mountains with limestone outcrops above 1800 m. He confirms there are two generations in Laos, in March to April, and again in August. The pre-imaginal stages were described by Igarashi (2001) from Vietnamese larvae.

## TROIDINI

### ***Losaria coon doubledayi*** (Wallace, 1865)

Dubois & de Salvaza (1919) recorded *Papilio coon* f. *doubledayi* from Vientiane, Laos, and in their 1921 paper specified the locality as 'forêt de Ban Sou Mone, Vientiane'. Motono & Negishi (1989) found it at Nam Moh in March and July, Pakxe in May and Dan Sum in February, April, June and October. Osada et al. (1999) pictured a male from Lak Sao caught at the end of January and a female from Thabok collected in March. Nimura & Wakahara (2005) found males of *Losaria coon* at Nam Dhua on 30<sup>th</sup> November and at Thabeng on 1<sup>st</sup> January. Both of these localities are on the main road to Vientiane (Highway 13) respectively north and south of the junction of Highway 8. The present authors found *coon* in small numbers every month in Hinboun District.

*Losaria coon* is distributed across the whole country (Osada, pers. comm.), being found in lowland forests near Vientiane, Vang Vieng

to Nam Tha in the north and throughout central and eastern Laos, south to Thakhek and Pakxe. According to Osada it is commonest in the rainy season. It was observed by the authors on Phou Pha Man in June and August, and the senior author even found a female inside his guesthouse in Thabok in late February. The junior author found two males at Koun Kham valley in January 2006, and Osada also found it there that February. Osada informed the authors that the most interesting aspect of the occurrence of *Losaria coon* is that it is only found in any one locality sporadically, rather than flying at the same place in particular seasons. In one year it may be common in one place, and the next not be seen there at all, but can be found at another locality.

Usually this species can be observed flying inside the forest, but will also visit flowers in open areas near forests, particularly during the rainy season. As with all Troidini, it uses its forewings to provide motion, beating them fast over a relatively small radius, and the hindwings are angled to change height and direction; unlike members of the other tribes, which beat all four wings when flying. The exceptions to this are those species which mimic Troidini, which also mimic the Troidine flight pattern.

### ***Pachliopta aristolochiae goniopeltis* (Rothschild, 1908)**

Dubois & de Salvaza (1921) listed *goniopeltis* for Laos, and Motono & Negishi (1989) found it at a range of localities across the country in February, May, July and August. Osada et al. (1999) pictured a male from Saravan, southern Laos, caught in March. Nimura & Wakahara (2005) found males of *goniopertis* (sic!) in several locations across central Laos at the end of December. The present authors only saw *Pachliopta aristolochiae* in the forest at Thabok during January and February, but found it on every visit to Hinboun District, where males and females were commonly seen in the forests in both valleys, in secondary growth and around the villages. In Lak Sao *aristolochiae* was seen from February to May, mostly males which came to drink at stream banks.

*Pachliopta aristolochiae* is found throughout the year and is seasonally common in low to medium elevations, in many different habitats from forest to rice fields and towns. Males are often seen in the mornings at banks of streams and feeding at flowers, and females

fly low over foliage in the undergrowth searching for the foodplant to oviposit.

One reason for the wide distribution of this species in many different habitats is its ability to utilise a wide variety of *Aristolochia* species as larval foodplant. During the rainy season it is often found near rice fields, where *Aristolochia pothieri*, a large species with trilobate leaves, is very often found beneath trees around the edges of the paddy. This *Aristolochia* is also found in secondary growth and gardens, and is also utilised by *Troides aeacus*, larvae of both species often being found together. As this *Aristolochia* dies back to the ground during the dry season, both species switch to feeding on other *Aristolochia* species at other times of the year, most of which only occur in forested habitats. The rapid growth of most *Aristolochia* species from April onwards provides plenty of larval foodplant, and is the reason for the large increase in population size of both species in June to September.

### ***Troides helena cerberus* (C. & R. Felder, [1865])**

Dubois & de Salvaza (1921) listed the male and light form of the female, form *gypsothelia* Jordan, 1909 for Laos stating that this form is predominant, and recorded a dark female, form *aselia* (sic!) Jordan, 1909 caught in June 1915 at Thado. Motono & Negishi (1989) found *cerberus* at Luang Phrabang from July to October, at Nam Moh and Ban Houei Sai in July, at Vang Vieng and nearby Phatong in March, and at Nam Ngum Dam in August. Osada et al. (1999) illustrated a male from Luang Phrabang and a light form female from Phong Saly, both captured in August. The present authors found *helena* at all the localities surveyed. In Thabok it was recorded in February and March, where males would occasionally drink at the sandy river bank, and in Lak Sao from March to May; but it was commonest in Hinboun District, where it was seen from February to August, and was particularly numerous in the damp forest on the lower west slope of Phou Pha Man, where both sexes could be observed feeding on flowering shrubs, particularly during the rainy season.

According to Haugum & Low (1985) specimens of *Troides helena* from eastern Laos are likely referable to the 1913 Fruhstorfer name *euthyocrates* (type locality Than Moi, Tonkin). They refuted attempts to synonymize the name with *cerberus* due to insufficient material

available at that time. The senior author has examined the series of specimens of *euthykrates*, both type and non-type material, in the Natural History Museum, London, and found *euthykrates* to be closer to *spilotia* Rothschild (type locality Hainan) than to *cerberus*. Examples of *Troides helena* from eastern Laos have all proved to be subspecies *cerberus* rather than *euthykrates*. It appears that *euthykrates* is confined to northeastern Vietnam, as specimens of *helena* from Sapa, in the northwest, examined in London belong to *cerberus*. There appears to be an unknown barrier separating the western and eastern areas of North Vietnam, as several species of Papilionidae are represented by different subspecies in Sapa and Hagiang, which is not much further east, on the other side of the Hồng river valley. It is interesting to note that these distinctions do not occur in all species; *Papilio bianor gladiator*, for instance, is found on both sides of the divide.

This species is seasonally common in hilly forested areas, with occasional specimens found outside the forest. Specimens of both sexes may often be observed feeding at flowering shrubs on forested hillsides. Males exhibit patrolling behaviour, waiting for females to appear, and interacting territorially with males of *aeacus* and *Pachliopta aristolochiae*.

Females of *Troides helena cerberus* are found in two forms. In Laos, and the rest of mainland Asia, the forewings are usually marked with pale stripes (form *gypsothelia* Jordan, 1909), similar to those of the commoner *Troides aeacus*, unlike in the Malay Peninsula where *helena* is the commoner species, and the dark form of the female (form *azelia* Jordan, 1909) is prevalent.

### ***Troides aeacus aeacus* (C. & R. Felder, 1860)**

Dubois & de Salvaza (1919) found *aeacus* across Indochina, and Motono & Negishi (1989) listed it from Tha Ngone, Vientiane, Ban Houei Sai and Nam Ngum Dam from July to September. Inayoshi (1996-2006) recorded a female from Pak Xong, Champasak caught on 24 March 1996, and Osada et al. (1999) pictured a pair from Vientiane, the male collected in October and the female in August. The present authors found *aeacus* at every locality between January and April. In Thabok it was also seen in August, and in Hinboun District it was found every month, where it was particularly common in January and February and again in June and August.

This is the commoner species of *Troides*, occurring throughout the country in a wide variety of habitats and altitudes, even being present in towns. It flies throughout the year, and is seasonally common in January to March and June to September. Larvae are often found on *Aristolochia tagala* in forests or *A. pothieri* at the edges of cultivated land. Males were observed patrolling the forest to feed on nectar of flowering shrubs, particularly *Mussaenda* species, and interacting with any females they might find. They were also found drinking at sandy banks of streams, particularly in the early morning, but also sometimes later in the day. One male photographed by the senior author while it was drinking at Koun Kham valley in January 2006 was soon afterwards found in small pieces, obviously having been attacked by a bird from the beak marks on the wings, which had been torn from the body.

This species can easily be distinguished from *Troides helena* in the male by the more acute anal angle of the hindwing, and the peppering of black scales at the edge of the golden yellow discal patch near the anal angle, which is not found in *helena*. The females can be separated by examining the black markings at the base of the hindwing. In *aeacus* this extends into the hindwing below the cell, whereas in *helena* it fills space 7 but does not enter space 1 below the cell. The female of *aeacus* also has a yellow discal spot in space 7 of the hindwing, which is absent in *helena*.

#### ***Atrophaneura aidoneus* (Doubleday, 1845)**

Dubois & de Salvaza (1921) first recorded *aidoneus* from Laos, but Motono & Negishi (1989) did not list it in their book. Osada et al. (1999) pictured a male and female collected at Xiang Khouang in October and June respectively. The present authors found *aidoneus* occasionally in Koun Kham valley and at higher altitude northeast of Lak Sao.

This species is the continental representative of the *priapus* group, sharing the characteristic pink edging to the anal scent fold of the male hindwing. It is confined to forested areas, where males may only normally be seen flying in deep shade, unlike females which will venture into open areas of the forest in search of nectar sources.

Wakahara (pers. comm.) informed the senior author that this species is found in thick low elevation forest along the Mekong river

valley from November to February, and before the beginning of the rainy season it migrates up tributaries to spend the rainy season in high altitude forests. The junior author collected a male of *aidoneus* at Koun Kham valley, 180 m, in late January, and the senior author observed males of this species in May on Phou Chomvoy, northeast of Lak Sao, at 900 metres patrolling inside the forest at about 4 to 6 metres above the ground, never leaving the dark undergrowth near the forest track, unlike females which would occasionally be found flying along the track. Osada also gave the senior author an old male that he caught in dark forest at Phong Si, which is near the Mekong river, on the morning of the day they met in the forest at Koun Kham, 20<sup>th</sup> February 2006.

Wakahara described the foodplant of *aidoneus* to the senior author, who subsequently found it in various localities in eastern Laos in dark, damp forest. The plants are much smaller than *Aristolochia pothieri* or *tagala*, with thin heart shaped pale green leaves, similar to the ornamental *Aristolochia ringens* from Central America, but without the pseudo-stipules at the base of the leaves. Unfortunately the senior author did not find any larvae, but Koiwaya & Wakahara (1999) illustrated the larva and pupa from Xiang Khouang, Laos.

### ***Atrophaneura varuna astorion* (Westwood, 1842)**

Hans Fruhstorfer [1903] recorded males and two females of this subspecies from Tonkin, but Osada et al. (1999) were the first to record *astorion* from Laos, picturing a male from Lak Sao caught in August 1998. Osada (pers. comm.) informed the senior author that *astorion* was not found near the Vietnamese border, but in forest about 12 km south of town, where he found it before 10 am flying with *aidoneus*. The senior author explored the area indicated by Osada in April 2006, but it had mostly been deforested. Wakahara (pers. comm.) said *astorion* can still be found in forest further south along the same road, and that *astorion* is only found to the east of the limestone mountains separating central and southern Laos. The present authors found it in Koun Kham valley from January to April and on nearby Phou Pha Man in June. Males from Koun Kham valley often have traces of white markings on the hindwing verso, suggesting that this population has genes in common with subspecies *zaleucus* from western Laos, which was born out by the discovery of a female

of *zaleucus* nearby in Koun Ngun valley. The senior author found a few almost identical specimens among typical examples of subspecies *zaleucus* from Chiang Mai and Ratchaburi, Thailand in the collection of St. Gabriel's College, Bangkok.

Vadim Tshikolovets, on a visit with the senior author, collected the first known female from Laos on 17<sup>th</sup> February 2006 flying in shade in the forest floor of Koun Kham valley at 180 metres. The senior author found a second specimen at 670 metres altitude in hills north-east of Lak Sao in May, and a few days later caught four more females feeding at *Mussaenda* flowers at 430 metres on the east side of Koun Kham valley at about 4 pm. These specimens all seem slightly different from females of *astorion* from India examined in collections. The tornal patch of the forewing is bluish grey rather than white, and is not as distinctly delineated as Indian *astorion*. It is unclear whether this observed difference is purely due to the age of specimens of *astorion* from India.

The population density of this species seems low, as a maximum of three males have been observed by the authors at Tad Nam Sanam Stream, Koun Kham valley in any one day. Single males can be found puddling early in the morning on some days, and occasionally have been seen patrolling an area of forest at about 10 am, but have not been seen later in the day. On days when up to three males patrol a particular area of forest a single female has usually been observed flying there. Often no specimens are seen at all in the same area on the next day. The authors believe that males patrol an area where they sense the presence of a female, and that on other days they search a different part of the forest.

The male of this species is easily distinguished from *aidoneus* by the dark anal fold of the hindwing, lacking the white scales with pink fringe of *aidoneus*. *Atrophaneura varuna* females can usually be separated from those of *aidoneus* by the red sides of the abdomen, rather than the pale pink median stripe found in *aidoneus*. However in older specimens this character is not constant, as the sides of the abdomen may fade to pink. The easiest way to confirm the identity of such a specimen is by examining the upperside hindwing cell. In both sexes of all subspecies of *varuna* this area is obviously darker than the rest of the hindwing, unlike in *aidoneus*, where the hindwing is uniformly coloured.

**Atrophaneura varuna zaleucus** (Hewitson, 1878)

This distinctive subspecies, with white discal spots on the hindwing, is found down the western side of Laos in forested areas in the Mekong river valley, and is also distributed in Thailand and eastern Burma. Occasional specimens of both sexes have the hindwing discal spots reduced or almost absent, giving them the appearance of subspecies *astorion*, and leading some people to think that these two taxa are sympatric, and thus separate species. Specimens of subspecies *zaleucus* without white discal spots on the upperside always have traces of these spots on the underside, and such specimens have also been found in northern and western Thailand. Inayoshi (1996-2006) illustrated the male genitalia of subspecies *varuna* and *zaleucus*, and they are almost identical. It is clear that *zaleucus*, *astorion* and *varuna* belong to the same biological species, intermediate specimens often being found in areas near the edge of the ranges of each subspecies. The authors therefore take this opportunity to synonymize *liziensis* Zhao, 1997 which was described from a single male collected in Lizi, Xizhang [= Tibet], China in July 1992. This specimen is clearly an example of *astorion* with *zaleucus*-like markings, and must be regarded as a synonym of the former (**syn. nov.**).

Dubois & de Salvaza (1919) first recorded *zaleucus* from Laos and Motono & Negishi (1989) found it in October at Thabok, Luang Phrabang and Vang Vieng. Osada et al. (1999) pictured a male from Vang Vieng collected in March. Osada (pers. comm.) observed large numbers of *zaleucus* feeding on flowers of *Sombucus chinensis* by the side of the road from Nam Tha to Muang Xing, northwest Laos in June. Osada also reported finding *zaleucus* in March at Oudomxay and Vang Vieng, and at Thateng in the south, also in March. The present authors only found a single male of this subspecies in Thabok on one occasion in late February 2006 at about 9.30 am, investigating the rocky stream bed, but not actually settling anywhere. The only other specimen found by the senior author was a female collected in a dry stream bed on the west slope of Phou Pha Man, Koun Ngun valley on the afternoon of 27<sup>th</sup> April 2006. This is a very significant record, as the locality is on the same mountain as subspecies *varuna* is found. Most specimens of subspecies *varuna* have been seen on the east side of the mountain, in Koun Kham valley, but subspecies *varuna* has also been found near the top of the road on the western slope, less

than one km away and only 200 metres higher. As the two valleys are connected at low elevation, it is clear that the mountain itself does not act as a barrier between the two subspecies, and explains the frequent occurrence of white markings on the underside of the hindwings of *astorion* found in Koun Kham valley. Wakahara (pers. comm.) informed the authors that this particular mountain is the meeting point for several taxa not found together elsewhere, such as all three species of *Pareronia* (Pieridae).

### ***Atrophaneura latreillei robus* (Jordan, 1928)**

Osada et al. (1999) first recorded this species in Laos, attributing it to subspecies *kabrua* Tytler, 1915, and picturing a female collected at Xam Neua on 9<sup>th</sup> April 1998. Tateishi (2001), when describing *Papilio bootes xamnuensis* also classified *latreillei* from the same locality as subspecies *kabrua*. Tytler (1915) described *kabrua* from Manipur and Naga hills, India, and later (Tytler, 1939) described subspecies *ticona* from Hthawgaw, in eastern Kachin State, Burma stating that the white discal patch of *ticona* is larger than that of *kabrua*. Jordan (1928), in his revision of the *latreillei*-group, described *robus* from Ngai-Tio, Tonkin, which is in the same range of mountains as Sapa, but much nearer the Chinese border. Examination of the types in the Natural History Museum, London, confirms that specimens of *latreillei* from Laos belong to this subspecies.

This species is the model for *Papilio bootes*, and is found rarely in northern and central Laos from about 800 metres upwards, usually in forests in the vicinity of 2000+ metre peaks. Tateishi (2001) stated that *latreillei* is commoner than *bootes* in Xam Neua, but the authors have seen more specimens of *bootes* than *latreillei* from there. The authors have seen specimens from Phou Phan, Xam Neua and Nam Cha, Xaysomboun. Wakahara (pers. comm.) also found it at Phou San, northeast of Ponsavan and Phou Khe, south of Xiang Khouang. The species has been recorded in February, March and April, but almost certainly flies several times a year. The lack of records for the rainy season is probably due to the difficulty of access to its habitat at this time of year, as the same species also flies in the rainy season in northern Burma.

### ***Atrophaneura crassipes* (Oberthür, 1893)**

Osada et al. (1999) were the first to record *crassipes* in Laos, picturing a male from Oudomxay caught in May and a female from Xam Neua collected in March. *A. crassipes* is distributed from Assam to North Vietnam, but in Laos is only found across northern areas. There is no obvious variation in populations across the range of *crassipes*, and no described subspecies. Wakahara (pers. comm.) informed the senior author that it may have three or four generations per year, is found only in the vicinity of the source of rivers but is not restricted to limestone mountains. He found it as far south as Nong Het in northeast Laos, and stated that the species is solitary, not being found in numbers. Osada (pers. comm.) found this butterfly in June flying with *Atrophaneura varuna zaleucus*, *aidoneus* and *dasarada* on the Nam Tha to Muang Xing road in northwestern Laos at about 1000 metres. He also recorded *crassipes* in Oudomxay, on the Muang Khoua to Phong Saly road in northern Laos and at Xam Neua in the northeast. Khamboun SP sent the senior author a pair of *crassipes* from Phou Phan, Xam Neua, caught in June 2006. These were identical to other specimens from India, Burma and Vietnam in the author's collection. This species is instantly recognisable due to the lack of any white markings on the hindwings, and red submarginal spots confined to the underside. The tails are also stubby, shorter than other species in the *Byasa* group of the genus *Atrophaneura*, and the male has distinctive swollen hind tibiae. The tails of the female are slightly larger than those of the male, and the hindwing lacks the androconial fold along the anal edge of the male hindwing, which is covered in powdery white scales.

### ***Atrophaneura adamsoni adamsoni* (Grose-Smith, 1886)**

Until just recently no subspecies of *adamsoni* had been described, apart from the nominate race. Uehara (2006) described subspecies *takakoe* from Koh Samui, South Thailand, and illustrated the type alongside a specimen of the nominate subspecies from Thon Kan, Luang Phrabang, Laos. Only three specimens of the new melanistic subspecies are known, the two types of Uehara from Koh Samui and a specimen from Nakorn Srithammarat pictured in Pinratana (1977). Until more specimens are seen its validity remains uncertain.

Dubois & de Salvaza (1919) first recorded *adamsoni* from Keng-Kabao, Laos. According to Khamboun SP (pers. comm.) this locality is near Savannakhet, his hometown. Motono & Negishi (1989) found it at Nam Ngum Dam in July, and Osada et al. (1999) pictured a male collected at Luang Phrabang on 31<sup>st</sup> July 1991. *Atrophaneura adamsoni* is extremely local in occurrence, Osada (pers. comm.) having only definitely found this species in Laos in July at Thon Kan. He observed what he thought was a specimen of this species at Thateng, South Laos, but was unable to confirm its identity. In Thailand the senior author has recorded this species from Mukdaharn, on the opposite bank of the Mekong from Savannakhet, so it is certainly likely that *adamsoni* occurs locally throughout Laos. Wakahara (pers. comm.) told the senior author that this species flies in low to mid altitudes, sometimes common at a particular place and time, at other times not seen at all in the same place. He has even seen it in Thabok, but the authors of this checklist have never seen it there.

This species appears at first glance similar to *Pachliopta aristolochiae*, but can be distinguished by the angled corners of the white hindwing discal patches, rounded in *aristolochiae*, and also in the male by the fully developed claspers and anal fold of the hindwing with copious white androconial scales. The senior author has recorded this species from various localities across Thailand in March, July, August and December, so it probably has at least three generations per year, but seems commonest during July.

### ***Atrophaneura laos* (Riley & Godfrey, 1921)**

Dubois & de Salvaza (1921) identified as *Papilio menci* the first known specimen of the then undescribed *Atrophaneura laos* from Nam Hin Boun, Laos. The junior author found this specimen in the Paris Museum, with a locality label 'Nahé'. This village is near the mouth of the Nam Hinboun river, with limestone hills nearby. In the same year Riley and Godfrey described the species from a single specimen caught by a Siamese [= Thai] collector on 23<sup>rd</sup> February 1920, originally believing the specimen to have been caught in Siam. Before the description was printed Godfrey learnt that the specimen was actually caught at Ban Na Sao, French Laos, and added this fact to the paper. It seems that Godfrey misunderstood the information about Ban Na Sao, because the original description states that '... Ban

Na Sao is actually in French Laos, E. of Saniabouri [=Xaignabouri], about 40 miles from the Siamese frontier.' In fact Ban Na Sao *is* east of Xaignabouri, but a long way east, near the Vietnamese border! The authors believe that the reference to '40 miles' was actually a reference to the position of Xaignabouri relative to the Siamese frontier, not to Ban Na Sao, as the sentence can be interpreted in two ways. The present authors even doubt that the holotype actually came from Ban Na Sao, which is in Xiang Khouang Province, south of Ponsavan. Khamboun SP (pers. comm.) informed the authors that there are no limestone hills in that area, and *A. laos* is not known from anywhere in that province, or in Xaignabouri. It is likely that the holotype actually came from the limestone hills east of the Mekong river in Khammouane Province, as this is the only area that the species is known to occur. Godfrey (1930: 208) reported a single specimen from Songkram river, Siam ('1♂: Mouth of Menam Songkram, Sayaburi (Sanyaburi), E. Siam. Also seen on the French Laos bank of the Mekong River.'). This is on the opposite bank of the Mekong from the true habitat of *A. laos*, and no further specimens have ever been found there. It is likely that this specimen was also actually captured across the river inside Laos, as it is unlikely that the specimen flew across the river, which is too wide to be able to see even large butterflies on the opposite bank, and there are no limestone hills on the Thai side.

*A. laos* occurs only in the Hinboun limestone hills from Phou Pha Man, on highway 8, south to Thakhek. It is not found in the limestone hills to the east of Phou Pha Man, near Lak Sao, despite their being nearby, probably because these hills are much dryer. It is often very common where it occurs, the authors having observed many specimens of both sexes flying at Phou Pha Man on numerous occasions in February, March, June and August. Inayoshi (1996-2006) recorded 68 males and 17 females collected by M. Nishimura at Ban Lao, Thakhek on 23-24 March 1995. Inayoshi (pers. comm.) informed the senior author that Mr. Nishimura collected the specimens as they came to feed at a flowering tree. It was also recorded by Osada et al. (1999), who pictured males caught at Thakhek in March and Nhahin in June, and a female from Thakhek collected in October, and by Nimura & Wakahara (2005) in late December at Thakhek.

At Phou Pha Man males fly down to drink from the damp road surface during the dry season after dawn before the sunlight dries the road, and during the rainy season also in the daytime when the

road surface is wet after a shower, but before the sun appears. Many specimens fall victim to passing vehicles as a result of this behaviour. In February both sexes can be seen feeding at the orange flowers of a tree, and in June the species favours *Mussaenda* flowers in the canopy. In August, however, the *Mussaenda* is not flowering, and males of *A. laos* prefer to visit white composites, *Bidens pilosa*, by the roadside, particularly in cloudy weather and light drizzle. At this time females were observed visiting a variety of flowers, including various shrubs and a species of *Bauhinia* as well as *Bidens*, which is an alien invasive weed, presumably only relatively recently found in Laos. On sunny days the species does not fly in the middle of the day, but will fly then if it starts to rain or is foggy.

Osada (1997) illustrated the first and last instar larva reared on *Aristolochia tagala*, the pupa, and the habitat of *Atrophaneura laos* in Thakhek. Wakahara (pers. comm.) told the senior author that *A. laos* utilizes a different species of *Aristolochia* in Thakhek to that in Phou Pha Man. Wakahara took the senior author 50 metres up the cliff face at Phou Pha Man to look for plants of the *Aristolochia* species that he claimed was the foodplant of *A. laos*. This plant was found growing from cracks in the limestone cliff face, above the tree line, among cactus-like Euphorbiaceae. The leaves are paler green, lanceolate, smaller and much narrower than *Aristolochia tagala*. Unfortunately the plant remains unidentified. The senior author also visited a location east of Thakhek where the other species of *Aristolochia* is found abundantly, growing a few metres above the base of the limestone cliffs. This is a small hanging vine with round, heart-shaped leaves, which was identified as *Aristolochia helix*. Wakahara (pers. comm.) stated that in Thakhek *A. laos* females lay their eggs singly on the limestone near the plants, rather than actually on the *Aristolochia*. Unfortunately the author did not see any larvae at either locality.

### ***Atrophaneura dasarada barata* (Rothschild, 1908)**

Dubois & de Salvaza (1919) first recorded *dasarada* in Laos at Thado, and in their 1921 paper they also listed it from Tathom; both localities are in Xiang Khouang. They regarded Lao specimens as f. *dasarada*, listing f. *barata* from Tonkin. Motono & Negishi (1989) found this species at Nam Moh in March, and Osada et al. (1999) pictured a male from Xaignabouri collected in April.

Subspecies *dasarada* actually comes from Assam and northern Burma, *barata* being the correct subspecies for Southeast Asia. Rothschild (1908) distinguished *barata* from the nominate subspecies principally by the paler colour of the area of the hindwing underside from the costa to the cell, which in *dasarada* is darker, the same tone as the rest of the hindwing.

This and the next species differ from the other tailed species of *Atrophaneura* (subgenus *Byasa*) found in Laos in that the anal fold of the male hindwing contains grey-brown scales rather than white ones. *Atrophaneura dasarada* can be distinguished from *polyeuctes* by the median submarginal spot of the hindwing being white rather than bright red, however some females of *polyeuctes* can appear at first glance similar to *dasarada*.

*Atrophaneura dasarada* is found in primary forest across Laos, mainly at elevation, but also in some lowland forest habitats. The authors found single males of this species in Koun Kham valley at only 180 metres, mud-puddling by the bank of the stream in the forest early in the morning. They were also occasionally seen during the day, when they would fly down to the stream bed keeping to the shade of the trees along the banks, rather than emerging into open sunlit areas. Other than at Koun Kham valley the senior author only found this species once near the Vietnamese border at 550 metres in April, again early in the morning, and never found either *dasarada* or *polyeuctes* in Thabok. Wakahara (pers. comm.) informed the senior author that *dasarada* is found across northern Laos, particularly at altitude, but is normally rarer than *polyeuctes*, and Osada (pers. comm.) found both species feeding on flowers along the Nam Tha to Muang Xing road in northwest Laos at about 1000 metres.

### ***Atrophaneura polyeuctes polyeuctes* (Doubleday, 1842)**

Dubois & de Salvaza (1919) first recorded *polyeuctes* in Laos using the species name *philoxenus* Gray, 1831, which is a homonym, and thus unavailable. Motono & Negishi (1989) found *polyeuctes* at Nam Moh in March and April, and Osada et al. (1999) illustrated a male from Nong Het caught in late August. Inayoshi (1996-2006) recorded 3 males and a female collected in the far south of Laos at Pak Xong, Champasak as well as two males from Doi Pee Ban Nam, Xaignabouri in the west of the country. *Atrophaneura polyeuctes* is

more widespread than *dasarada*, being found in forests across Laos. Osada (pers. comm.) found this species to be common on the Nam Tha to Muang Xing road in the northwest in May and June, and at Nong Het near the Vietnamese border in eastern Laos. The only locality where he found *polyeuctes* in South Laos was on a mountain near Pak Xong on the Bolovens Plateau. He reports that this locality is also infested with leeches.

The senior author occasionally found males of this species drinking at the edge of a stream near the Vietnamese border east of Lak Sao at 550 metres. It was particularly common at 890 metres on Phou Chomvoy, northeast of Lak Sao, where it was observed mud-puddling in numbers in May. Females were also occasionally seen mud-puddling, separately from males, and observed to oviposit on *Aristolochia tagala* near the edge of the road in the forest at this locality. The absence of this species in Koun Kham valley is notable, despite the presence of *dasarada* at the locality. *Atrophaneura polyeuctes* flies throughout the day, and can be seen in open sunlit areas in the middle of the day, not confining itself to the shade.

## PAPILIONINI

### ***Meandrusa lachinus sukkiti* Nakano, 1995**

*Meandrusa lachinus* was clearly shown to be a separate species from *Meandrusa sciron* by Funahashi (2003), who found them to be sympatric in Hagiang, North Vietnam, and also stated that the hindleg structure of the two species (which he refers to as *hercules* Blanchard, 1871 and *gyas* Westwood, 1841; both names long ago replaced by *sciron* Leech, 1890 and *lachinus* Fruhstorfer, [1902] respectively, due to homonymy) is different: '*Menandrusa* (sic!) *hercules* and *Menandrusa* (sic!) *gyas* had collected from same locality, Hajiang North Vietnam and also two epiphysis of the hind legs present in *M. gyas*, while one epiphysis of the hind legs present and longer in *M. hercules*. The colour of the legs are different. So they are independent species clearly.' Note that grammatical errors and misspelling of *Meandrusa* in Funahashi (2003) are as quoted. Funahashi misuses the term epiphysis, which is a specialised spur, covered in scales, on the inner edge of the tibia of the fore leg of all Papilionidae, when he is actually referring to spines at the tip of the tibia on the hind leg.

*M. lachinus* is found in mountainous forests across Laos, but it is as yet unclear whether all populations belong to the same subspecies. Subspecies *sukkiti* was described from Nan Province, Thailand, near the border of Xaignabouri Province, Laos, from two males and a female. Wakahara (pers. comm.) collected a male at the highest point on the Nam Tha to Muang Xing road in northwest Laos, and also saw this species in Phong Saly. It is possible that specimens from northwest Laos actually belong to subspecies *aribbas* Fruhstorfer, 1909, as it is this subspecies that is found in North Vietnam and northernmost Thailand. Until a female from northwestern Laos is captured the subspecific identity will remain uncertain, as the differences between subspecies *sukkiti* and *aribbas* are only obvious in the female, males being very similar. The female of *aribbas* is very similar to that of subspecies *lachinus* from India, with a broad white discal band from the angle of the cell of the forewing down to the anal angle of the hindwing, whereas the female of *sukkiti* has the discal band restricted to the lower part of the forewing and upper hindwing, often reaching the hindwing cell but not crossing it.

Dubois & de Salvaza (1919) first recorded this butterfly in Laos (as *Papilio gyas*) from Thado. Motono & Negishi (1989) found it 15 km north of Vang Vieng in April. Osada et al. (1999) pictured a male from Lak Sao collected in March and a pair from Xam Neua, the male caught in May and the female in April. The senior author has seen a series of both sexes of *sukkiti* from Phou Phan, Xam Neua collected in March and April, and found a male of this subspecies near the Vietnamese border east of Lak Sao in February 2006 drinking at a water seepage at the base of a slope in the early afternoon. Osada (pers. comm.) has found several males near the Vietnamese border at Lak Sao, and also on a mountaintop at Nong Het, and saw males hilltopping in Thateng, southern Laos; and this subspecies was also recorded from the far south of the country by Inayoshi (1996-2006) who collected a female of subspecies *sukkiti* at Pak Xong, Champasak on 26<sup>th</sup> March 1996. Wakahara (pers. comm.) stated that he often only saw this species when it flew up from the ground beneath his feet as he walked through the forest; due to its habit of sitting still perfectly camouflaged on the ground, only flying away when in close proximity.

### ***Meandrusa payeni langsonensis* (Fruhstorfer, 1901)**

Dubois & de Salvaza (1919) first recorded *payeni* from Thado, Laos, as f. *evan* Doubleday, 1845, which is the subspecies from Assam. Motono & Negishi (1989) record this species from central Laos in March and August, Inayoshi (1996-2006) lists a female from Pak Xong, Champasak, south Laos caught on 28 March 1996, and Osada et al. (1999) pictured a pair from Phong Saly collected in March 1995 and a male from Vang Vieng caught on 14<sup>th</sup> October 1997. *Meandrusa payeni* occurs across the whole of Laos but is rarely seen in nature, as it does not congregate with other butterflies when visiting water. If settling to drink by a stream bank it will sit alone, often on a patch of wet rotting leaves, always sitting stationary with narrow brown crescent shaped wings closed, perfectly camouflaged as a dry leaf. The senior author has only seen this species occasionally across the localities surveyed; it was seen from Thabok to the Vietnamese border at Lak Sao, but only ever singly, and always in the afternoon or early evening. Usually males were seen visiting stream banks, but on a single occasion in August 2005 a male was observed to fleetingly visit a white composite, *Bidens pilosa*, by the roadside on Phou Pha Man, Hinboun district, before flying away. Khamboun SP recently sent the senior author a male and two females collected at Phou Phan, Xam Neua in June 2006. Osada (pers. comm.) reports that both species of *Meandrusa* are strongly attracted to red colour; he even caught several females of *payeni* in Phong Saly by using a red net to attract them.

### ***Papilio paris paris* Linnaeus, 1758**

*Papilio paris* is seasonally common in many forest types throughout Laos at all elevations, but is not normally seen outside forested areas. It has several generations per year, and can usually be seen in small numbers all year round in lowland forests. The wet season form is generally larger than that of the dry season, as is common to many species of *Papilio*. Dubois & de Salvaza (1919) recorded both the spring and summer forms of *paris* from Indochina, using the name *splendorifer* Fruhstorfer, 1909 for the spring form. Motono & Negishi (1989) recorded *paris* from various localities in north, central and south Laos between March and September. Inayoshi (1996-2006) recorded a male from Pak Xong, Champasak

in the far south of the country caught in March. Osada et al. (1999) illustrated two males (March and September) and a female caught in November, all from Phong Saly. In Thabok the senior author found it to be common at the end of January and in February and again in August; and in June it was common in Koun Ngun valley along the streams which are dry rocky beds until the start of the rainy season. In Lak Sao it was common in April about 5 km from the Vietnamese border, where males gathered at water seepage on a rocky slope on the riverbank along with *Papilio bianor*, *dialis*, *nephelus*, *helenus* and *protenor*, as well as various *Graphium* species. The senior author tasted this water and found it to be noticeably salty. It is generally believed that males need salt ions to mature their spermatophores before mating with females, and it is significant that the percentage of very fresh specimens among butterflies attracted to salty seepages is high. Females of most species are very rarely seen drinking at such places, and when seen, they always sit well apart from the males.

Males of this and other species of subgenus *Achillides* (the 'Gloss Papilios') are attracted to shiny blue and green objects. When mud-puddling males of *paris* will sit stationary with forewings lying flat, swept back over the hindwings obscuring the bright turquoise hindwing patch. It is notable that in this posture the green forewing submarginal band is perfectly aligned with the green discal band in spaces one and two of the hindwing. Females may occasionally be found around flowers in the forest, but are not seen often.

There is considerable variation in the presence, length and intensity of the pale green submarginal band of the forewing upperside, dry season specimens generally have a better developed band, and wet season specimens often have no band at all, but some dry season specimens also have no band, and some wet season specimens have a complete band. There are also intermediate examples found throughout the year.

### ***Papilio arcturus arcturus* Westwood, 1842**

This species is found at altitude across northern Laos, and was first recorded there by Dubois & de Salvaza (1921) from Xiang Khouang. The senior author has seen many specimens from Phou Phan, Xam Neua, and Osada et al. (1999) pictured two males and a female from this locality collected in March, April and May. Inayoshi (1996-2006)

recorded four males from Doi Pee Ban Nam, Xaignabouri collected in March, September and November. Wakahara (pers. comm.) reports it as common in April on Phou Khe, Xiang Khouang, and also found it on Phou Yon, east of Ponsavan. He states that there are at least three generations per year. He also recorded three males at only 600 metres altitude near the Vietnamese border east of Lak Sao in early March many years ago, but the senior author has never seen *arcturus* there. The senior author did find a single male on Phou Chomvoy, northeast of Lak Sao, at 1020 metres in May 2006 but did not find even a single specimen at lower altitudes, between 600 and 900 metres, in the same area over a period of several days. The specimen was observed sitting at a mud puddle with forewings swept back over the hindwings in the same posture as *Papilio paris*, and it was only positively identified after capture, when the distinct narrow dark blue metallic discal patch became visible.

The female is similar to the male, which is variable in the intensity of the pale green submarginal band on the forewing, which normally reaches vein 4 from the tornus, but never reaches the costa. This band can be shorter and less pronounced in some specimens, and very occasionally absent.

### ***Papilio krishna* Moore, [1858]**

The senior author obtained a series of thirteen specimens of *Papilio krishna* and nine *Papilio bootes* from an Australian lepidopterist with data Phong Saly, June 2006, which originated from a Chinese dealer living in Vientiane. Examination of these specimens showed them to be identical to specimens from Sichuan, China, which is surprising, as Yunnan specimens of both species are distinctly different from those from Sichuan. Indeed *Papilio bootes* from Xam Neua, northeastern Laos and Xaysomboun, central Laos belong to subspecies *xamnuensis*, which is obviously different from the specimens supposedly from Phong Saly in several ways, but especially in the presence of pink scales on the lobe of the tails, absent in the Sichuan subspecies *nigricans*, which has totally black tails. The specimens of *Papilio bootes* supposedly from Phong Saly all had black tails and a smaller white hindwing discal patch than specimens of *xamnuensis*. The specimens of *krishna* obtained by the senior author were all identical to subspecies *charlesi* from Sichuan, whereas they

would be expected to look more like subspecies *thawgawa* from Yunnan or *mayumiae* from northern Vietnam.

The senior author has also received a specimen of *Graphium mandarinus* from the UK with data Vang Viang, central Laos, June 2001. This specimen also was obtained from the same Chinese dealer in Vientiane by a UK lepidopterist who visited Laos a few years ago. This specimen is also an example of the Sichuan subspecies of *mandarinus*, very different from the specimens known to occur in central Laos, which fly in late February, not June, the month they would be found in Sichuan.

Khamboun SP (pers. comm.) has never seen either *Papilio krishna* or *bootes* in Phong Saly, despite having been there many times to study butterflies. Wakahara (pers. comm.) has also never heard of *Papilio krishna* from Phong Saly, and does not believe that it could be found there, as the mountains are not high enough. This species is normally found only on mountain ranges with peaks over 3000 metres, even though the butterflies can be found as low as 1500 metres on the slopes of these mountains, and there are no such high mountains in Phong Saly. Wakahara also told the senior author that the Chinese dealer in Vientiane is 'not reliable'. Wakahara believes it is possible *Papilio krishna* may be found on Phou Bia, the highest mountain in Laos at 2880 metres, but no specimens have yet been seen.

It is deplorable that specimens can be sold with false data in order to charge a higher price than Sichuan examples would demand, especially as the Chinese dealer in Vientiane claimed to the senior author to be a coleopterist who is 'purely selling specimens to finance his scientific studies'. The senior author has contacted a major European Lepidoptera dealer, who confirmed that his specimens of Lao *krishna* were obtained from the same source.

In conclusion, it is certain that specimens of *krishna* supposedly from Phong Saly which have been sent around the world Lepidoptera collectors' market all actually originate from Sichuan, China, and that *Papilio krishna* is not yet known from anywhere in Laos.

### ***Papilio dialis doddsi* Janet, 1896**

Cotton & Racheli (2006) discussed this taxon in some detail, showing that the type locality of *doddsi* Janet, 1896 is actually in the mountains of eastern Laos, not Tonkin [= northern Vietnam] as often

quoted. Dubois & de Salvaza (1919) reported this subspecies from Laos, and as f. *andronicus* Fruhstorfer, 1909 from Thado, near Nong Het. Presumably they must have found a tailed specimen, which they separated from *doddsi* as *andronicus*, which was described from Formosa [= Taiwan] but is a homonym of *Papilio andronicus* Ward, 1871. The current name for the Taiwanese subspecies of *Papilio dialis* is *tatsuta* Murayama, 1970. Osada et al. (1999) pictured three males and a female from Lak Sao, all caught in March. Osada (pers. comm.) confirmed that Lak Sao here refers to the hills on the Vietnamese border about 25 km east of Lak Sao. Khamboun SP (pers. comm.) reports it to be common near the Vietnamese border east of Thakhek, which is the continuation of the same range of mountains at Lak Sao, about 100 km further south. Other than these localities *dialis doddsi* is only known in Laos from a single male captured at Thabok in late February 2006 by the senior author, recorded in Cotton & Racheli (2006). This specimen is notable in being slightly brighter green rather than the normal deep blue tone. This is probably only a case of individual variation, possibly due to the warmer climate at low elevation in Thabok.

The senior author recently examined the syntype of *schanus* Jordan, 1909 (label: Siam Frtr., S. Shan States) in the Rothschild Collection, Natural History Museum, London as well as a specimen from S. Shan States in the Main Collection of that Museum, and a photograph of a specimen in the Paris Museum from 'Haut Tonkin et Bas Yunnan'. They all fall within the normal variation of subspecies *doddsi*, and as such *schanus* must be regarded as a synonym of *doddsi* Janet, 1896 (**syn. nov.**). The other syntype, stated by Jordan to be deposited in the de Nicéville Collection, Calcutta was not examined.

This butterfly is notably seasonal, very few specimens being found in between generations. The first generation in Lak Sao flies in late February and early March and the second generation emerges in early May. Osada (pers. comm.) reports that the first specimen found at this locality by a Japanese collector was caught in October, so there must be at least three generations. The authors only found a single male in January and two in April at the Vietnamese border near Lak Sao. The senior author has only ever found a single specimen with stubby tails similar to one of the males pictured in Osada et al. (1999), all other specimens have the tail only indicated by a stump at vein 4. In northern Vietnam tailed examples are commoner, as they are in

subspecies *cataleucas* from Hainan, which may be tailless, have short or fully developed tails. The nominate subspecies from China has full sized tails.

The authors have never seen any females of this taxon from Laos except the specimen illustrated by Osada et al. (1999), which is almost identical to the males, but lacks androconial streaks on the forewings. The senior author has a female from Hagiang, North Vietnam in his collection, which is similar to the male except for the lack of androconia on the forewings and the presence of well-developed red submarginal crescents on the upperside in spaces 1b to 5 of the hindwing. This specimen has half developed tails similar to a male from the same locality. Another female in the senior author's collection from Tam Dao, Vietnam, is almost identical to males from Lak Sao, except for the lack of androconial scales on the forewings and generally paler markings.

When drinking at mud males of *doddsi* sit with wings closed or half open, not flat against the ground like *paris* and *arcturus*. The senior author has found *dialis* as high as 890 metres altitude in Phou Chomvoy east of Lak Sao, but it is less common there than at 660 metres near the Vietnamese border and it was also found further downstream at 550 metres, but in lower numbers. This species is probably confined to low to mid altitude forests, and the only Chinese specimen the senior author has seen with an altitude record was collected at 800 metres in Liaoning. It is notable that *dialis* is absent from Phou Phan, Xam Neua, where *Graphium phidias* also occurs, indicating that these two species do not share the same distributional limitations.

### **Papilio elephenor** Doubleday, 1845

Osada et al. (1999) question the identity of the *elephenor* recorded by Dubois & de Salvaza (1919, 1921) from Thado (near Nong Het). It seems unlikely that Dubois & de Salvaza would have made an erroneous identification, as they were conversant with the literature on Lepidoptera of the day, and also recorded *dialis doddsi* at the same locality. *Papilio elephenor* is instantly distinguishable from *Papilio dialis* by its buff-yellow frons on the head, which is unmistakable. The palpi are also buff-yellow, as is the base of the head behind the eyes. There have been no records of this elusive species since then

in Laos, and Thado is also a very inaccessible place (Khamboun SP, pers. comm.).

A modern record of *elephenor* in North Vietnam (Shinkai 1999) seemed to add to the likelihood that Dubois & de Salvaza did find *elephenor* at Thado, but Osada (pers. comm.) says he understands the report of the capture of *elephenor* in North Vietnam was a misidentification, actually *dialis doddsi*. Wakahara (pers. comm.) confirmed this, stating that the Japanese collector who caught the specimen was not familiar with the Papilionidae, and assumed it must be *elephenor*. There is also a questionable old record of a pair of *elephenor* from Doi Suthep, Chiang Mai, Siam (Godfrey 1930). A Thai lepidopterist, Kampol Sukhumalind (pers. comm.), believes this record was probably actually a pair of *Papilio memnon*, but this seems doubtful. It is more likely that these were specimens of *dialis*, since Jordan's syntype of *schanus* was collected very near there on the border of Siam [= Thailand] and Shan States. The whereabouts of the specimens mentioned by Godfrey is unknown, and the senior author did not find them when he spent 2 months examining the Godfrey Collection in the Department of Agriculture, Bangkok in 1980.

It is possible that *elephenor* was once found across tropical Asia in suitable habitats, but with widespread deforestation and changes in climate it may be extinct throughout much of its range. Wakahara (pers. comm.) believes this species may be confined to wet mid-altitude forest on limestone mountains, similar to the habitat it is known from in Assam and Manipur. He believes it is possible that this species may be found in such habitats on a limestone mountain in central Laos near Phou Bia.

### ***Papilio bianor gladiator* Fruhstorfer, [1902]**

The subspecific identity of the various local populations of mainland Asian *Papilio bianor* has been unclear for many years, due to multiple names being proposed for wet and dry season forms of specimens from across Asia comprising two basic phenotypes, the darker *bianor* type and the green *polyctor* type which has a bright blue-green hindwing discal patch. *Papilio bianor* was first described by Cramer from China in 1777, almost certainly from specimens collected in the vicinity of Canton (John Chainey, of the NHM, London, pers. comm.), and *Papilio polyctor* was described by Boisduval in 1836

from specimens of a very different looking butterfly from Cashmere with bright green bands on the forewings and a bright iridescent green discal patch on the hindwings. Doubleday described *Papilio ganesa* from Nepal and North Bengal in 1842. The types of *ganesa* were stated by Doubleday to be deposited in the British Museum, but the senior author was unable to find any specimens in the collection there that are old enough to be potential type material of *ganesa*, all specimens in the collection of the Natural History Museum, as it is now known, were collected in the late 1800s or last century.

*Papilio bianor gladiator* was described by Fruhstorfer [1902a] from Chiem Hoa, Tonkin; the type series being wet season specimens of the *bianor* phenotype collected in August to September 1900. Fruhstorfer (1902d) described *triumphator* as the *polyctor* subspecies from Assam, comparing it to *ganesa* from Sikkim, and *significans* as a subspecies from Tandong, Tenasserim with a pale mark near the tornus of the forewing. He later found some specimens at Chiem Hoa which he referred to *polyctor* rather than *bianor*, naming them *polyctor titus* in 1909. This led Jordan (1909) to believe that *bianor* and *polyctor* were separate species, since their ranges appeared to overlap, and the taxa were regarded as separate species by all subsequent authors until Harada (1992) published the results of a breeding program for *bianor* in Sichuan. Harada found that some *polyctor*-like specimens were obtained from rearing progeny of the *bianor* phenotype, proving that the phenotypes are conspecific.

Several new names were introduced in the 1900s: *polyctor stocleyi* Gabriel, 1945 from Melamoung, West Siam, and *polyctor pin-ratanai* Racheli & Cotton, 1983 from Chanthaburi, southeastern Thailand, are distinct geographically isolated subspecies. Chinese authors introduced several new names for previously named taxa; three Chinese authors Chou, Yuan and Wang (Chou et al. 2000) even describing a male and female of subspecies *bianor* from Lu Shan, Sichuan as separate species, *Papilio elegans* and *Papilio pulcher*! Lee (1962) described *Papilio polyctor kingtungensis* from Yunnan; Chou (1994) described *polyctor xiei* from Mengla, Yunnan, just across the border from Phong Saly, Laos; and Wang & Niu (2002) described an aberrant specimen of *bianor* from Luoshan, Henan with enlarged submarginal lunules on the hindwing underside as a new species *Papilio longimacula*. The present authors take this opportunity to sink *elegans* Chou, Yuan & Wang, *pulcher* Chou,

Yuan & Wang and *longimacula* Wang & Niu as synonyms of *Papilio bianor bianor* **syn. nov.**

Nishimura (1997) synonymized the various *polyctor* phenotype names *significans*, *gladiator*, *titus*, *kingtungensis* and *xiei* with *ganesa*; treating *polyctor*, *ganesa*, *stockleyi* and *pinratanai* as the only valid subspecies of *Papilio polyctor*. He also stated that if as authors suggest, *polyctor* and *bianor* are conspecific, then his interpretation of *ganesa* should be subsumed within a single nominate subspecies *bianor*.

Inayoshi (1996-2006), following Nishimura (1997), placed *bianor* from Laos and Vietnam under subspecies *ganesa* Doubleday, 1842, which was described from Nepal and North Bengal. Shizuya et al. (2002) classified *bianor* from Kachin State, northern Burma (which are the same phenotype as those from Meghalaya, and Assam south of the Brahmaputra river) as subspecies *gladiator*, not as *ganesa*. The present authors agree with Shizuya et al. (2002) and believe *gladiator* and *bianor* to be distinct from true *ganesa*, the type of which came from north of the Brahmaputra river valley, and is closer in appearance to subspecies *polyctor*, with distinct green submarginal bands on the forewings of almost all specimens. These green bands are amorphous or absent in the majority of specimens from south of the Brahmaputra river and eastwards; and, when present, are always less developed than those of *ganesa*. The bright green hindwing patch is also much larger and more distinct in true *ganesa*, about the same size as that of *Papilio paris*, whereas in *gladiator* this patch is smaller and duller, often being dark blue and non-metallic, similar to the discal patch of subspecies *bianor* from China.

This difference in phenotype is clinal from West to East from Meghalaya across northern Burma, Yunnan, Laos and Vietnam, with the percentage of specimens with a green hindwing discal patch decreasing gradually eastwards to Vietnam. Both authors have examined a large series of specimens referable to *gladiator* from Likiang [= Lijiang], northern Yunnan in the collection of the ZMFK in Bonn. The majority of these specimens have a small shiny green hindwing discal patch, but a significant number are *bianor* like. In Laos the green patch is usually present, but mostly not as pronounced as further west; and in northern Vietnam, where the types of *gladiator* originate, the majority of specimens are similar to subspecies *bianor*, but some specimens of the green phenotype are also found. Since this is a clinal variation without any unique characters to differentiate

any one population across the west-east cline the present authors conclude that all the populations from Meghalaya to Vietnam must be regarded as belonging to a single subspecies, *Papilio bianor gladiator*, and the populations in China from Sichuan to Jiangsu and south to Guangdong should be treated as *Papilio bianor bianor*, despite occasional green phenotypes occurring in Sichuan.

The present authors believe that Nishimura (1997) was incorrect in regarding *significans* as a synonym of *ganesa*, as it represents an intermediate, but well defined, race between *gladiator* and *stockleyi*, which is found a little further south on the Thai-Burmese border in the Dawna Range. The female of *significans* is quite different from that of *gladiator*, as it has a large pale patch near the tornus of the forewing, looking very like subspecies *stockleyi*; and the male, somewhat similar to *gladiator*, has a much better developed green hindwing patch than either *gladiator* or *stockleyi*, and has a pale green mark, often with cream scales, at the tornus of the forewing approaching that of *stockleyi*, which is very prominent and almost white. Thus the present authors are reinstating *Papilio bianor significans* as a valid subspecies, **stat. rev.**

The distribution and synonymy of the various subspecies of *Papilio bianor* in mainland Asia (excluding the subspecies found in Taiwan, the Japanese Islands and Korea, some of which may prove to be separate species) can be summarised as follows:

*Papilio bianor bianor* Cramer, 1777

China from Sichuan eastwards to Jiangsu and south to Guangdong

syn. *connectens* Mell, 1938 (homonym of *connectens* Fruhstorfer, 1906)

syn. *elegans* Chou et al. 2000 **syn. nov.**

syn. *pulcher* Chou et al. 2000 **syn. nov.**

syn. *longimacula* Wang & Niu, 2002 **syn. nov.**

*Papilio bianor polyctor* Boisduval, 1836

Northwestern Himalayas

*Papilio bianor ganesa* Doubleday, 1842

Nepal to Bhutan and Assam north of the Brahmaputra river

*Papilio bianor gladiator* Fruhstorfer, [1902]

Meghalaya, Assam south of the Brahmaputra river, northern Burma, Yunnan, to Laos and Vietnam

syn. *triumphator* Fruhstorfer (1902)

syn. *titus* Fruhstorfer, 1909

syn. *kingtungensis* Lee, 1962

syn. *xiei* Chou, 1994

*Papilio bianor significans* Fruhstorfer, 1902 **stat. rev.**

Mandalay, Shan States and northern Tenasserim

*Papilio bianor stockleyi* Gabriel, 1945

Dawna Range of hills on the Thai-Burmese border of Tak Province and Kayin State

*Papilio bianor pinratanai* Racheli & Cotton, 1983

hills near the Cambodian border in Chanthaburi Province, Southeast Thailand

*Papilio bianor* is found throughout most of northern and central Laos, mainly in forested areas, but specimens can often be found visiting flowering plants in secondary growth near forest habitats. Dubois & de Salvaza (1919) first listed *gladiator* from Thado, Laos; and Motono & Negishi (1989) recorded it from many localities in central Laos in March, July, August and October. Inayoshi (1996-2006) also recorded a male from Doi Pee Ban Nam, Xaignabouri at the end of October 1989, and the senior author has several specimens from the same locality in his collection. This subspecies also can be found in nearby Nan Province, on the Thai side of the border, and there is a specimen received in 1933 by the Natural History Museum, London from Chiang Saen, Chiang Rai Province, collected by Col. Stockley. Fujioka et al. (1997) also pictured a male from Chiang Dao, Chiang Mai Province collected in March 1981, as well as many specimens of *bianor* from across the range of the species.

There are no records of *gladiator* from southern Laos, although it should occur there, as there are two specimens in the Natural History Museum from Phnom Penh, Cambodia. It is notable that *bianor* is absent from the forest in Hinboun district, never having been observed there by the authors, despite being one of the commonest *Papilio* species in nearby Lak Sao, where the first generation flies from mid January to March. The second generation flies from April to July, and there is a third generation in August to October. In between generations the species can also be found in smaller numbers. In Thabok the first generation emerges slightly later, in February, and is not as common as in Lak Sao.

First generation males are relatively small and more brightly coloured, usually with the red submarginal lunules of the hindwing clearly marked on the upperside as well as the underside. Second generation males are mixed phenotypically, some are like first generation specimens, but usually slightly larger, some are like small third generation specimens and some are intermediate. The third, wet season, generation looks markedly different to the first; specimens are much larger and darker in colour, the red of the submarginal

lunules confined to the underside of the hindwings in the male, but present on the upperside in the female. Colour shift of the hindwing discal patch from blue-green to pure green can occasionally be seen in individual specimens of several subspecies of *Papilio bianor*; there are several examples of this variation illustrated by Shimogori (1997), such as a pair of *bianor ganesa* from Godavari, Nepal pictured on page 33, a male of *gladiator* from Kunming, Yunnan (placed under subspecies *bianor* by Shimogori) on page 26, and a male of *bianor significanus* (sic!) on page 35. Shimogori (1997) also pictures wet season specimens of *gladiator* from Nan and Xam Neua as *polycolor triumphator* on pages 36 and 37.

### ***Papilio demoleus malayanus* Wallace, 1865**

*Papilio demoleus* was found across Indochina by Dubois & de Salvaza (1919), who commented on the variability in the pale spotting, from almost white to orange. This difference in colour is mostly due to age of the specimen before capture, rather than true variation. On emergence fresh specimens are very pale, and the colour deepens with exposure to sun as the butterfly flies about. Individuals can live a long time, and also travel long distances. Motono & Negishi (1989) recorded *demoleus* from Nam Ngum Dam in February, Tha Ngone in April, Vientiane in May, Ban Houei Sai from May to July, and Luang Phrabang in August. Inayoshi (1996-2006) listed a male from Xam Neua caught in June, and two males from Pak Xong, Champasak collected in March. Osada et al. (1999) pictured a male caught on July 31<sup>st</sup> in Luang Phrabang. Nimura & Wakahara (2005) found *demoleus* at Nhahin at the end of December, and at Nakai, which is about 50 km south of Lak Sao, at the end of November. The present authors recorded *demoleus* at Thabok between February and June, at Thakhek on the one day in March that the senior author collected there, and most commonly at Hinboun District, where it was recorded from February to August.

This species is commonly known as the Lime Swallowtail, as it feeds on a wide range of species of *Citrus* and other Rutaceae; so is seasonally common throughout Laos both in forest and in populated areas, even in large cities, where people often grow *Citrus* plants in their gardens. *Papilio demoleus* is found at least in small numbers throughout the year, but has peaks in population numbers

approximately every three months. It can be seen around flowers in cultivated areas and dry secondary growth more often than in primary forest, but males were often found mud-puddling in the dry season in the forest at Thabok. It was also often seen in Koun Kham village, and feeding on flowers along the roadside in both Koun Ngun and Koun Kham valleys, but less often observed inside the forest.

*Papilio demoleus* has a swift flight pattern, and is able to quickly enter suitable new habitats. Matsumoto (2002) explains the spread of this species through Indonesia and The Philippines in the latter part of the 20<sup>th</sup> Century partly due to deforestation, particularly in The Philippines and Sumatra, and increased cultivation of *Citrus* by local inhabitants. He also recorded intermediate specimens on Borneo between subspecies *libanius* Fruhstorfer, which invaded from Taiwan through The Philippines to Borneo, and *malayanus*, which entered Borneo either directly from the Malay Peninsula or via Sumatra, which it was able to colonize after massive deforestation in the 1960s and 70s.

### **Papilio demolion demolion** Cramer, 1776

This Sundaland species is rarely seen in forests across Laos, being at the northern limit of its range. Dubois & de Salvaza (1919) listed *demolion* as occurring in Indochina. It was recorded as far north as Luang Phrabang by Motono & Negishi (1989) in March and May, and at Nam Ngum Dam in August. Osada et al. (1999) pictured a pair from Lak Sao, collected in August and September. Nimura & Wakahara (2005) found a male in Thabok at the end of December, and three males at Nam Dhua around new year. The present authors found occasional specimens at Thabok in February and March, and a single male in Koun Kham valley in January.

Wakahara (pers. comm.) informed the senior author that *demolion* favours open places and secondary growth, rarely being seen near streams in the forest. He states that it is common around Vientiane city in the dry season, and even photographed an example of this species inside the airport terminal building. He also found it to be common in the garden of a guesthouse near Lak Sao town centre, where the larval foodplant, a medium sized tree in the family Rutaceae, grew. Wakahara has reared the larvae, which are gregarious. He reports that the larvae and pupae are almost identical to those of the closely related species *Papilio noblei*, which also has gregarious larvae. The

senior author also observed that both species have a similar stance when mud-puddling, usually sitting stationary with wings spread flat and forewings swept back over the upper half of the hindwings.

***Papilio noblei*** de Nicéville, [1889]

*Papilio noblei*, similar to *Papilio antonio* from the Philippines, only occurs in mainland South East Asia, from southern China to Laos, Burma and a few localities in northern Thailand. Nishimura (1997) showed that the male genitalia of *noblei* are actually closer in appearance to *demolion* than to *antonio*. It can be distinguished from *Papilio helenus* by its smaller size and extension of the white hindwing discal patch into the cell. The submarginal lunules on the hindwing underside are orange-yellow rather than red. This species is very variable in the amount of white on the discal band on the hindwing underside, which occasionally crosses the whole hindwing to the anal angle.

There is also considerable variation in the size of a white patch at the lower edge of the forewing near the tornus. This patch can occasionally reach from the edge of the wing to space 2, be present in spaces 1a and 1b, in only space 1a, or absent altogether. Three subspecies were described based on specimens with or without this patch, and two of these, *henricus* Oberthür, 1892 and *hoa* Gabriel, 1945, both described from Tonkin, were synonymized with *noblei* by Nishimura (1995) who stated that these were purely seasonal morphs. To this synonymy can be added *haynei* Tytler, 1926 (**syn. nov.**), the type of which, from Myitkyina, was identified and examined in the Natural History Museum, London, and found to be typical of *noblei* without a white patch on the forewing. Tytler separated *haynei* from *noblei* on the basis that the Burmese specimens he had seen all lacked a white patch on the forewing. Shizuya et al. (2002) pictured at least two male specimens of *noblei* from northern Kachin State, Burma, and a male mud-puddling, which may be one of the specimens pictured; all with well developed white forewing patches. The senior author found specimens with and without this patch throughout the year in Laos, so the presence or absence of a white forewing patch must be regarded purely as individual variation. Thus *Papilio noblei* is confirmed as a monotypic species with considerable individual variation. The female of this species is identical to the male.

Dubois and de Salvaza (1921) first recorded this species in Laos, collected in March 1918 at Ban-van-Nam. The location of this village name could not be ascertained by the authors of this paper, and Khamboun SP did not know this place-name. Motono & Negishi (1989) also recorded *noblei* from Vang Vieng in May, and Inayoshi (1996-2006) lists a male from Doi Pee Ban Nam, Xaignabouri, collected on 30<sup>th</sup> October 1989. Osada et al. (1999) pictured males from Thabok in March and Nam Tha in September, and a female from Lak Sao collected in September. Osada (pers. comm.) informed the senior author that this specimen was collected in forest 12 km south of the town. Wakahara (pers. comm.) reports *noblei* to be common in Luang Nam Tha and Vang Vieng in August.

Unlike *Papilio demolion*, this species is confined to forests. The senior author found males to be seasonally common mud-puddling on stream banks in the forest at Thabok in February, March, June and August, with some specimens seen as early as January. It probably also has at least one more generation there in the late rainy season, but the author was unable to visit at that time of year. In between generations only occasional worn specimens were seen. It was also found in smaller numbers at Koun Kham valley from February to April in 2006, but not seen there the year before; and the senior author caught a female near the Vietnamese border east of Lak Sao in March 2006 despite never having seen a male there.

### ***Papilio helenus helenus* Linnaeus, 1758**

Dubois and de Salvaza (1919) recorded *helenus* across Indochina, attributing specimens to two forms, *helenus* Linnaeus, 1758 and *daksha* Hampson, 1888, the latter actually occurring in southern India. Inayoshi (1996-2006) listed seven males from Doi Pee Ban Nam, Xaignabouri collected in August, and a male from Pak Xong caught in March. Osada et al. (1999) pictured a pair from Lak Sao and a male from Nong Het, all caught in March. Nimura & Wakahara (2005) found *helenus* in November, a female at Thabok and two males at Nakai. The present authors found *helenus* at all localities visited, and in at least small numbers every time.

*Papilio helenus* is found commonly throughout the year in forested habitats across Laos, but does not usually venture out into cultivated land and towns. This butterfly is easily distinguished from

similar species in Laos by the row of bright red submarginal lunules on the underside of the hindwing. Subspecies *helenus* is found throughout the East Asian mainland, from northern India to China and south to the Malay Peninsula. It can be seen in forest at every altitude, from lowland to mountaintops at 2000 metres, unlike *Papilio nephelus*, which is confined to low to medium altitude forests. Males are frequently seen congregating on stream banks or wet sand, where they usually sit with wings almost closed but still beating, rather than still. If they stop beating their wings they will sit with wings flat, forewings swept back over the white hindwing patch. The female of this species is similar to the male, but has a larger white discal patch on the hindwing, often extending into the upper part of space 4. Females were occasionally seen feeding at flowers in the forest, but males are much more frequently encountered. At low altitudes *Papilio nephelus* far outnumbers *Papilio helenus*, but *helenus* becomes the commoner species above 600 metres.

*Papilio helenus* exhibits some variation, with dry season specimens often having red submarginal rings on the upperside of the hindwings as well as the underside. There is also some variation in the size of the white hindwing patch, particularly the spot in space 7, which may be reduced or occasionally absent.

### ***Papilio prexaspes pitmani* Elwes & de Nicéville, [1887]**

Cotton and Racheli (2006) discussed the distribution and spelling of the name of this taxon, which was originally named as *pitmanii*, but under the current ICZN Code the shortened name must be retained due to overwhelming prevailing usage. In that paper they did not consider another name for this taxon, *siamensis* Godfrey, 1916. Godfrey described this as a new subspecies of *Papilio hipponous* from Pak Jong, eastern Thailand, supposedly distinguished from *pitmani* by two characters on the hindwing underside; white as opposed to cream discal band and larger submarginal lunules. Examination of specimens of *pitmani* in the Natural History Museum from southern Burma and western Thailand including possible type material showed clearly that the characters quoted by Godfrey to separate *siamensis* from *pitmani* are shared by those specimens. Therefore *siamensis* Godfrey, 1916 must be regarded as a synonym of *pitmani* Elwes & de Nicéville, [1887] **syn. nov.** It is not surprising that there is no

difference between specimens of this taxon from Burma and western Thailand and those from eastern Thailand and Laos since this species is confined to low elevation forests, and until relatively recently the whole of the central Thai plain was forested, and hence not a barrier to distribution of this butterfly.

In Laos *pitmani* is restricted to lowland areas in the Mekong valley. Motono & Negishi (1989) recorded it from Vang Vieng and Phatong in March and Osada et al. (1999) illustrated males from Thabok in March and Vang Vieng in April. The senior author found it in Thabok from the end of February through March to April, but did not find it at any of the other localities explored further east. It is surprising that this species has never been seen at the lowland forests in Koun Kham or Koun Ngun valleys, Hinboun district, but it should occur in southern Laos. Wakahara (pers. comm.) recorded this species from forests west of Vientiane, at Vang Vieng and as far north as Luang Phrabang. He states there is a second generation in May, but the authors were unable to visit the forest at Thabok in May to confirm its occurrence then, due to a damaged bridge, which made the road impassable. Khamboun SP (pers. comm.) found a female of this taxon feeding on flowers in his garden on the outskirts of Vientiane, but the senior author has never seen a female from Laos. A female in his collection from Khao Soi Dao, Chanthaburi Province, Thailand is similar to the male, but slightly larger and has a diffuse pale submarginal band from the tornus of the forewing curving to the leading edge beyond the apex of the cell. Many males have a vestige of this band consisting of beige scales only near the tornus of the forewing, but it is often totally absent.

### ***Papilio castor mahadeva* Moore, [1879]**

The taxon *mahadeva* Moore, [1879] has been regarded as a separate species from *castor* Westwood, 1842 in modern literature, including Osada et al. (1999), purely because *mahadeva* has a complete hindwing band, whereas *castor* has white spots in spaces 5, 6, 7. Jordan (1909) placed *mahadeva* as a subspecies of *castor*, realising that the two taxa are connected by intermediate subspecies in Burma, and the present authors fully agree with Jordan.

The subspecies is seasonally common in lowland forest in central and southern Laos, flying during the middle of the day. Dubois & de

Salvaza (1919) first recorded *mahadeva* from Laos, but in their (1921) paper only listed *mehala* as present in Laos, separating specimens from Annam and Tonkin as *mahadeva*, while also listing *mehala* from Annam. Whether they misidentified Lao *mahadeva* as *mehala* is unclear, as no locality was mentioned in either paper. Motono & Negishi (1989) recorded *mahadeva* from Pakxe, south Laos in July, Vang Vieng in October and Tha Lat, north of Vientiane in August. Inayoshi (1996-2006) lists two males collected at Vang Vieng in May and June, and Osada et al. (1999) pictured a male and female caught in March and September respectively at Nhahin. The senior author found *mahadeva* at lowland forest localities in Thabok and Hinboun District, but it was not seen in the Lak Sao area. Wakahara (pers. comm.) states that he has never found this species in northeastern Laos.

Both sexes are good mimics of *Euploea* species, with a similar flight pattern, but *mahadeva* can immediately be recognised when sitting on a flower to feed due to its posture. *Euploea* species sit with wings closed, but *mahadeva* sits with wings spread out flat. Males also behave like *Papilio* species rather than *Euploea* when mud-puddling, beating their wings as they drink, rather than sitting still on the ground with wings closed.

### ***Papilio castor mehala* Grose-Smith, 1886**

This subspecies is found from Shan States, Burma to north-western Laos, where it is found in the Nam Tha area, near the border with Yunnan. The male occurs in two forms, one similar to subspecies *mahadeva*, but with broader hindwing discal patches, and the other distinguished by the incomplete hindwing band, similar to the nominate subspecies, the latter form being commoner in Laos. Wakahara (pers. comm.) reared both forms from a single female, and found the *castor*-like form to be much commoner than the one with a complete discal band (80% to 20%). The senior author examined a large series of specimens of this subspecies in the Natural History Museum, London from southeastern Burma, where the *mahadeva*-like form is slightly commoner than the *castor*-like form and there are also intermediate specimens. The female is similar to that of *mahadeva*, but with larger discal spots in hindwing spaces 4-7. The male is also variable in that the row of white submarginal lunules on both wings may be absent in dry season specimens. Osada et

al (1999) placed this race as *Papilio castor dioscus* (sic!) Jordan, 1909. The correct spelling of the taxon they refer this population to is *dioscurus*, described by Jordan from four males collected by Fruhstorfer at Than Moi, Tonkin [= North Vietnam], but examination of the syntypes showed them to have distinctly narrower white discal patches on the hindwings. A specimen placed under *dioscurus* in the Main Collection of the Natural History Museum, London, from Haut-Tonkin, Rivière Noire, ex Oberthür Collection, differs from the others in having wider discal spots, similar to *castor*, and may actually be referable to *mehala*. If, when further material from Vietnam becomes available, *dioscurus* proves to be a synonym, *mehala* will have priority as the older name.

Wakahara (pers. comm.) reported this taxon to be very common around Nam Tha town, where it feeds on *Citrus* plants in gardens; and Osada (pers. comm.) found many larvae of this species and *Papilio polytes* on an unidentified species of Rutaceae on the forest floor behind rice fields near the Nam Tha to Boten road. *Papilio castor* has not yet been found in northeastern Laos, possibly due to lack of suitable low to mid elevation forest habitats, this species not usually being found at high elevation.

### ***Papilio nephelus chaon* Westwood, 1845**

Dubois & de Salvaza (1919) recorded *Papilio chaon* from across Indochina; and Motono & Negishi (1989) found this species at Tha Ngone in April, Nam Moh in July and Luang Phrabang in September. Inayoshi (1996-2006) listed a male from Vang Vieng caught in June, and two males from Pak Xong collected in late March. Osada et al. (1999) figured two males from Thabok and a female from Lak Sao, all caught in March. The present authors found *nephelus* at all localities sampled. In Thabok it was not found in January, but was the commonest species of *Papilio* seen from February onwards. At Hinboun District *nephelus* was recorded in January, but in low numbers, and was again very common from February onwards. Females were commonly seen in Koun Ngun valley and on the western slope of Phou Pha Man feeding on flowering shrubs by the roadside, particularly in the rainy season. In Lak Sao *nephelus* was not recorded until March, and was noticeably less common at 660 metres than at 550 metres, where it was less common than in the lowland forests in Thabok and Koun

Kham. It was found near the Vietnamese border until July, and surely also is present later in the year, but the authors were unable to record it there in August due to bad weather.

This is by far the commonest species of *Papilio* found in lowland and mid altitude forest throughout Laos, often outnumbering all the other *Papilio* species drinking at mud puddles. It is not found at high altitude, generally being confined to forest up to about 1000 metres. This species is easily recognisable by the white hindwing patch reaching across four spaces, rather than only three as in *helenus*. The submarginal lunules on the hindwing underside are ochre yellow or cream rather than red, but are highly variable in size, from totally absent to fully developed lunules in all interspaces. The female always has well-developed hindwing markings, with an indistinct pale discal band across the forewing from the apex of the cell curving down to the tornus, which may be only indicated on the upperside especially in dry season females. Occasionally males are found with traces of white spots at the tip of the forewing cell, particularly on the underside, showing the affinity of this subspecies with *nephelus* from Sundaland, which was originally thought to be a separate species until the intermediate subspecies *annulus* Pendlebury, 1936 was found in the south of Thailand and northwestern Malay Peninsula. Another common variation is in the length of the white patch in space 4 on the hindwing; in most specimens of *chaon* this spot is shorter than the spot in space 5, unlike in Sundaland subspecies, but occasional specimens of *chaon* can be found with an elongate white patch in space 4. Fruhstorfer (1908b) described several taxa based on variations of subspecies *chaon*, such as *dispensator* from Tonkin, *duketius* from Siam and *ducenarius* from Tenasserim, but they are all synonymous with this subspecies.

### ***Papilio polytes romulus* Cramer, 1775**

Dubois & de Salvaza (1919) first recorded *polytes* in Laos, listing it for Indochina and noting the various forms found. Motoso & Negishi (1989) listed *polytes* at Tha Ngone in April, June and July; at Vientiane in May and July; at Luang Phrabang in July, September and October; and at Ban Houei Sai and Nam Ngum Dam in August. Inayoshi (1996-2006) recorded two males at Pak Xong caught at the end of March. Osada et al. (1999) pictured males from Lak Sao,

Vientiane and Nam Dhua collected in February, March and August respectively, and a female from Thakhek caught at the end of August. Nimura & Wakahara (2005) recorded a female at Namdhua collected on 30<sup>th</sup> November. The present authors found *polytes* at Thabok from February to August, and at Hinboun District every month visited, but only found it occasionally near the Vietnamese border, in March and May. Females were commonly observed during the rainy season on flowering shrubs in Koun Ngun valley, but the male-like form was rarely found.

*Papilio polytes* is another *Citrus* feeding species, which is commonly found both in forests and towns across Laos throughout the year; and similarly to *demoleus* it has several peaks in numbers through the year. *Papilio polytes* is, however, more common in forest habitats than *demoleus*. The female occurs in two forms in Laos, the rarer form is male-like, and the common form mimics *Pachliopta aristolochiae*, from which it can easily be distinguished by body colour, black in *polytes* as opposed to red in *aristolochiae*. In India the same subspecies has an extra form which mimics *Pachliopta hector*, with white bands across the forewings. This form bears the subspecies name, as Cramer's type was a female of this pattern. The *aristolochiae* mimic is generally known as form *stichius* Hübner, 1806, but this name is actually referable to females of subspecies *polytes* from China. The male-like form was named *cyrus* Fabricius, 1793. Clarke & Sheppard (1972) discussed the genetics determining the phenotype of the females of *Papilio polytes*, showing it to be 'controlled by allelomorphs at a single autosomal locus and not by independent genes'.

Males and females can often be seen feeding at flowers, and many were observed feeding with *Papilio nephelus* and *memnon* on pale pink flowers of *Bauhinia* shrubs by the roadside in Koun Ngun valley during the rainy season. Males were also commonly found mud-puddling in lowland forest in February and March and again in June to August.

*Papilio polytes* can be easily distinguished from the similar *prexaspes* by the presence of white marginal spots up the forewing from the tornus. There is relatively little variation in the male; mainly this is evident in the intensity and presence of submarginal lunules on the hindwing underside, which may be pale to bright orange or red when present. The mimetic form of the female in Laos varies in

the white discal patch of the hindwing, which may be augmented by a spot in the apex of the cell or only present outside the cell.

### ***Papilio protenor euprotenor* Fruhstorfer, 1908**

Dubois & de Salvaza (1919) first recorded *Papilio protenor* from Laos. Motono & Negishi (1989) list specimens from Vang Vieng in March and October; Phatong which is about 10 km north of Vang Vieng also in March; and from Luang Phrabang in April and September. Inayoshi (1996-2006) lists a male from Ponsavan caught at the end of June. Osada et al. (1999) pictured a pair from Phong Saly collected at the end of August and beginning of September 1993. Wakahara (pers. comm.) has found *protenor* across northern and central Laos at many localities, and Khamboun SP (pers. comm.) reports it to be common in Xam Neua.

The male of this species is easily confused with *Papilio memnon* or *alcmenor* at first glance, but can be distinguished by the white scales filling the upper part of space 7 on the upperside of the hindwing and the difference from either species in the red markings on the underside of the hindwings. *Papilio protenor* lacks any red marks at the base of the wings, unlike *memnon* and *alcmenor*, and has a series of submarginal red lunules from space 1a to space 7 which are somewhat variable in size, some specimens also with a series of marks on the margins between veins which can be pale or tinged with red. The red anal eyespot on the upperside of the hindwing is complete, with a black centre. The discal area of the hindwing upperside is peppered with light blue scales from space 4 to 7, these scales often also present in the apical area of the cell. Some specimens have a reduced amount of this blue peppering, which can be restricted to the upper part of the hindwing.

In the area surveyed the authors only found this species in the vicinity of Lak Sao, where it was common near the Vietnamese border, and on Phou Chomvoy at 900 metres, when visiting this locality in May. This species was usually the first *Papilio* to be seen near the border in the morning after the temperature has risen sufficiently for activity, and it would be seen flying along the stream again in the early afternoon. Vadim Tshikolovets, on a visit with the senior author, found a female at about 10am inside the forest near the border in February 2006, but females were not seen in the open area along the

stream. The senior author found *protenor* at this locality every month between January and June, and it will certainly be present there later in the year.

***Papilio alcmenor alcmenor* C. & R. Felder, [1865]**

This species occurs in forest across north and central Laos, with several generations per year. Dubois & de Salvaza (1919) first recorded it for Laos as *Papilio rhetenor* Westwood, 1841, which is a homonym, *alcmenor* C. & R. Felder, [1865] being the oldest available replacement name. Motono & Negishi (1989) found it at Vang Vieng in October, and Osada et al. (1999) pictured males from Lak Sao and Nhahin collected in September. It was found by the present authors to be common in lowland forest at Thabok and Hinboun district in late January to March and again in August, with occasional specimens found throughout the year. Zakharov et al. (2004) scored this species as only being mimetic in the female in their character analysis, but in fact the male is a good mimic of *Atrophaneura varuna* and *aidoneus*, the red markings near the base of the underside of the wings mimicking the red body of those species. In flight this mimicry is also obvious, as *alcmenor* adopts the Troidine type flight pattern discussed above under *Losaria coon* rather than the faster tumbling flight typical of *Papilio* species. The authors have often mistaken males of *alcmenor* flying down the stream at Koun Kham valley for *varuna* or *aidoneus* until they settle to drink at a muddy bank.

There is considerable variation in the male, with red basal marks present on the forewing upperside in some specimens, particularly in the dry season. Mostly the area near the tornal angle of the forewing is as dark as the rest of the wing, but occasional specimens were seen with white scales there, but never as concentrated as may be seen in specimens from countries further west. There is also considerable variation in the anal spot on the upperside of the hindwing, which may be almost absent, red or white, sometimes prominent. On the underside of the hindwing the extent of the red markings is also somewhat variable, some specimens having additional red submarginal lunules in spaces 3 and 4.

Females, which mimic *Atrophaneura polyeuctes*, were only seen by the senior author on two occasions around Phou Pha Man, Hinboun District but were never seen in Thabok, despite the male being

commonly seen around streams in the forest there. Wakahara (pers. comm.) found females to be commoner flying at hilltops and along ridges, only rarely venturing into the valleys. On the one occasion, in May 2006, the senior author saw a female in the valley below Phou Pha Man the weather was very windy higher up the mountain, and it is likely this specimen had flown into the valley to shelter from this wind.

### ***Papilio bootes xamnuensis* Tateishi, 2001**

Motono & Negishi (1989) first recorded *bootes* in Laos from Nam Moh, Xiang Khouang in March as '*Papilio janaka <bootes mixta>*', but did not illustrate the species. Osada et al. (1999) pictured a pair from Xam Neua as *Papilio bootes mixta*, the male collected on 25<sup>th</sup> October 1997 and the similar female collected on 27<sup>th</sup> April. Tytler (1915) described *mixta* from Naga Hills and Manipur, northeast India, but *bootes* from Laos is somewhat different, *mixta* having a larger white discal patch on the hindwings. The two populations are also separated by several very different subspecies in northern Burma and Yunnan.

Tateishi (2001) described *Papilio bootes xamnuensis* from Xam Neua, comparing it with the nominate subspecies from Khasi Hills, Meghalaya, and provided a short description of the early stages. The native foodplant is *Glycosmis pentaphylla* (Rutaceae) but Tateishi raised the larva in Japan on *Citrus natsudaoidai*. The larvae are typical of most *Papilio* species, the first to fourth instars resembling bird droppings and the fifth instar is green. The pupa was brown, but Tateishi speculated that there is probably also a green form, as is normal for many *Papilio* species. Green pupae are found pupating on the foodplant, whereas brown pupae are produced by larvae that wander away to pupate elsewhere, usually on tree trunks. Tateishi (2001) stated that the egg hatched after six days, and the larva took thirty days to mature, with the pupal stage lasting sixteen days. He also reported on its behaviour, flying at noon, when it would be seen visiting flowers to drink nectar in forest at about 800 metres. He reported that the model for this mimetic butterfly, which he called *Byasa latreillei kabrua* (see *Atrophaneura latreillei robus* above), is commoner than *Papilio bootes*, but both are rare, and they occur in the same locality at about the same time. However, Khamboun SP (pers comm.) has found *bootes* to be commoner than *latreillei*, and the senior author

has only seen a few specimens of *latreillei* from Laos compared to many more *bootes*. Smith (1989) pictures *Papilio bootes janaka* and *Atrophaneura latreillei latreillei* puddling together in Nepal. Tateishi (2001) recorded *bootes* as flying from March to May in Xam Neua.

Wakahara provided the senior author with a series of specimens of *xamnuensis* collected at Nam Cha, Xaysomboun, 1250 m at the end of February and beginning of March, and some photographs of this butterfly mud-puddling. He pointed out the unusual posture of *bootes*, which sits with wings slightly opened, and its abdomen and hindwings pointing up at 45° from the ground, clearly showing off the red sides of the abdomen and the hindwing pattern. Other mimetic *Papilio* species sit with body parallel to the ground, similar to the non-mimetic species. It is notable that *bootes* is the only *Papilio* species with red on the body; all other mimetic species have black bodies and red markings at the base of the underside of the wings. The head and sides of the thorax and abdomen are red in *Papilio bootes*, but the upperside of the thorax, abdomen and valvae are black. *Papilio bootes* also has red markings at the base of its wings in addition to a red body. Wakahara (pers. comm.) reports that there are in fact three generations of *bootes* per year, flying in March-April, July-August and again in October. He has recorded this species from Phou Khe and Phou San in Xiang Khouang as well as Phou Phan, Xam Neua and Phou Bia, and stated that *Atrophaneura latreillei* emerges slightly before *bootes*, as would be expected in a mimetic relationship.

This subspecies is somewhat variable in the size of the white discal patch on the hindwing. In some specimens this patch is present only in spaces 3 and 4, but there is often an extra small spot in space 5, and often also in space 2. Specimens with a white discal spot in space 2 normally have the outer margin of the discal spot edged with red scales on the underside. The female is larger than the male, and all three specimens seen had large discal patches on the hindwing.

### ***Papilio memnon agenor* Linnaeus, 1758**

*Papilio memnon* is another species that can exploit a variety of habitats due to its ability to feed on a wide range of Rutaceous plants, including cultivated *Citrus*, the smaller varieties of which it rarely uses compared to *polytes* and *demoleus*. It will feed on Pomelo, *Citrus grandis* as well as other Rutaceae (Igarashi 1979), and adult

females also use the flowers of this tree as a nectar source. It is not very often seen outside the forest until the rainy season when both sexes can be seen around cultivated areas, nectaring by the roadside and in gardens. It is distributed throughout Laos at all elevations, and occurs most commonly in lowland to mid elevation forest where it can be seen throughout the year. Dubois and de Salvaza (1919) listed *Papilio memnon* for Indochina, recognising two forms of the female across the region and a third in Haut-Tonkin. Motono & Negishi (1989) recorded it across central Laos from March to September, and Inayoshi (1996-2006) listed a male from Ponsavan caught at the end of June. Osada et al. (1999) pictured males from Thabok and Luang Phrabang collected in September, a female of form *agenor* from Muang Khoua, north Laos, caught in June, and a female of the tailed form *distantianus* found at Luang Phrabang at the beginning of August. Nimura & Wakahara (2005) found males in Nam Dhua and Thakhek in November and December. The present authors found this species on all eleven visits to Laos between January and August, and at every locality sampled. It was seen in large numbers in lowland forest in February, March, June and August, and females were seen most often in August, when they would visit flowering *Bauhinia* and various species of Verbenaceae, including *Clerodendrum* shrubs on the western slope of Phou Pha Man.

The male is tailless and normally non-mimetic, with the rapid flight pattern of most *Papilio* species, except for when feeding at flowers when it adopts a slower, more *Troidine*-like flight. This may purely be the result of such a large butterfly having to slow its flight pattern down while feeding at flowers, or may be a mimetic adaptation to a high-risk activity. The authors, observing flowering shrubs along the roadside on Phou Pha Man, Hinboun District, often at first glance mistook males of *Papilio memnon* for *Atrophaneura laos*. Males were commonly seen mud-puddling near streams in the forest, where they normally sit with wings almost closed but still beating.

The male exhibits parallel variation with other *Papilio* species, in the frequent increase in red markings among dry season specimens. Often there is a well-developed red streak at the base of the forewing cell on the upperside, and some specimens have a red anal spot on the hindwing upperside, occasionally approaching that of *Papilio deiphobus rumanzovia* of the Philippines in intensity. Vadim Tshikolovets, on a trip to Lak Sao with the senior author in February 2006,

caught an interesting aberrant male near the Vietnamese border. This specimen had a broad red stripe running along the whole of the anal edge of the hindwing in space 1, connecting the red basal mark to an enlarged red area at the apex of the hindwing, similar to the pattern of *Papilio alcmenor*.

The female is a mimic of several species of the tribe Troidini in Laos, particularly *Losaria coon* and *Atrophaneura varuna zaleucus*. The *coon* mimic, form *distantianus*, is tailed, and obviously larger than *coon*; unusually for a *Papilio* the abdomen has ochre yellow sides. The *zaleucus* mimic, form *agenor*, is tailless with a black abdomen and white discal spots on the hindwings, which are much reduced in dry season specimens. Clarke et al. (1968) discussed the genetics of this species and conclude that inheritance of the various female forms 'is controlled by a series of at least eleven autosomal alleles at one locus, sex controlled to the female'. Surprisingly the authors have never seen any of the other forms of the female from Laos, particularly the dark form *rhetenorina*, which mimics *Atrophaneura aidoneus* and is found from India at least to northern Thailand, so should be present in Laos. Interestingly, some rainy season specimens of form *agenor* from Hinboun District have an enlarged white hindwing patch with additional white markings on the forewings, often coalescing into a diffuse white discal band from the tornus to the tip of the cell. These white markings are even more prominent on the forewing underside. The author has a similar specimen in his collection from Mukdaharn, which is further south on the Thai side of the Mekong river, but has never seen any specimens of this type from other parts of Thailand. It is possible that this form actually mimics female *Troides*, which are common in the area at the same time, and have diffuse pale stripes on the forewings. Clarke et al. (1968) cite forms of *memnon* females which mimic *Troides* in Sumatra and Java.

### ***Papilio clytia clytia* Linnaeus, 1758**

*Papilio clytia* is the first of five species of the group often known as *Chilasa* found in Laos. These species are all mimics of Danainae and feed on *Litsea* species (Lauraceae). Zakharov et al. (2004) have shown them to be the Asian representatives of the American subgenus *Pterourus*, rather than belonging to subgenus *Papilio* like all the other species in Laos, which feed on Rutaceae. The name *Chilasa* Moore,

[1881] should be regarded as a synonym of *Pterourus* Scopoli, 1777 rather than a valid genus, but can be used as the oldest available name for this group of species.

*Papilio clytia* feeds on *Litsea glutinosa*, a common tree in secondary growth, and probably feeds on other species of Lauraceae in evergreen forest. Traditionally local people used the strong smelling leaves of *Litsea glutinosa* to make shampoo. Interestingly live males of *clytia* have a distinctly perfumed fragrance, which is not so obvious in the female. Igarashi (1979) illustrated the early stages of this and all other species of the *Chilasa* group found in Laos except *paradoxa*, with the early stages of *clytia* on plate 107. The fifth instar larva of *clytia* is very distinctive, black with white marks and 4 rows of red spots down the body, which has spiny tubercles. The pupae of these butterflies are stick-like, similar to those of *Pterourus* species, and not angled like those of the other Asian *Papilio* species.

This species has many different forms in both sexes, which mimic various species of *Euploea* and *Parantica*. Dubois & de Salvaza (1921) recorded 7 named forms from Laos. Motono & Negishi (1989) recorded *clytia* from many localities in central and northern Laos in April, May, July, August and December. Inayoshi (1996-2006) listed 3 males from Champasak, South Laos caught in March and Osada et al. (1999) pictured 5 forms collected in March at Thabok and Saravan, July in Luang Phrabang, and October in Xaignabouri. The present authors recorded *clytia* in small numbers at all localities sampled. In Thabok and Hinboun District it was found in February, March, April and June, but it was uncommon near the Vietnamese border at Lak Sao, only being seen there in March. *Papilio clytia* is found in forest, even at altitude, but is commoner in secondary growth and around populated areas, feeding on flowers. It is tolerant of hot dry conditions, which many species of butterflies avoid.

Unlike *Papilio memnon* or *polytes* the same mimetic forms are seen in both sexes of *clytia*. There are two basic types with named variations; brown with spots and short stripes, and dark brown with long pale stripes filling each vein space on both wings. The first type mimics various species of *Euploea*, and the second mimics *Parantica* species, and all forms copy the typical lazy soaring flight of Danaine butterflies. The common character to all forms of *Papilio clytia*, which enables easy distinction of this species from Danaines and other mimetic Papilionids, is the presence of a row of large yellow spots

on the margin of the hindwing underside. These spots are instantly visible when the butterfly is mud-puddling, as this species sits stationary with its wings closed when drinking water, as do *Euploea* and *Parantica* species.

The *Euploea* mimic is separated into several named forms with occasional intermediates. Form *clytia* has short discal stripes on the hindwing and cream submarginal spots on the forewing. This is the commonest form among the *Euploea* mimics. A similar form, *onpape*, only differs from form *clytia* in that the submarginal spots on the forewing are extended to the margin, particularly noticeable at the apex of the forewing where the streaks are elongate. This form looks very like *Euploea core godartii* in flight. Another form of the same basic type, but with the submarginal spots of the forewing black instead of cream, is called *janus*. This form is less common, but the authors found several examples at Koun Kham valley. Occasional specimens of this form have cream scales at the centre of the black spots. The last form of this basic type has a darker, unmarked forewing with a metallic blue sheen, and usually with longer discal stripes on the hindwing, mimicking the *Euploea* species with a blue sheen on the forewing. This is called form *papone*, and is not uncommon in Thailand, but the authors have never seen any examples from Laos, although it was recorded as present by Dubois & de Salvaza (1921) and Osada et al. (1999) pictured a male of *papone* from Thabok. Dubois & de Salvaza (1921) also recorded another form at Ban-Sai in May 1919, called *commixtus*, which is known from India, but never recorded from Thailand, and not known to the present authors from Laos. This is intermediate between the two basic form types, with a brown forewing and a hindwing with pale streaks in each space reaching the wing base.

The second basic type mimics *Parantica* and *Tirumala* species, and has pale stripes filling all the vein spaces on both wings. Most examples of this type are form *dissimilis*, with the pale stripes broader than the dark stripes along the veins, and this looks a good mimic of *Parantica aglea* in flight, although larger. The variation on this form with thinner pale stripes, looking much darker, is known as *dissimillima*, and is rarer than *dissimilis*. Osada et al. (1999) pictured a male of this form from Saravan, southern Laos. This form is a mimic of the common Danaine *Tirumala septentrionis*.

**Papilio paradoxa telearchus** Hewitson, 1852

*Papilio paradoxa* mainly occurs in low elevation evergreen forests, and can be found occasionally at mid elevations below 1000 metres. It has two colour forms in the male and one in the female. The common form of the male, form *telearchus* mimics *Euploea mulciber* with its distinctive metallic blue forewing; and the much rarer form *danisepa* mimics *Euploea radamanthus*, often known as *diocletianus*. This has a white patch at the apex of the cell imposed on the metallic blue forewing, and white from the base of the hindwing in spaces 1 to 7 and the cell, to the discal area where they are tinged with blue at the edges. Dubois & de Salvaza (1919) first recorded *paradoxa* in Laos, finding form *danisepa* in Vientiane, and in their 1921 paper gave the locality as Nam-tié. Whether this is a correction for the origin of the first specimen or a new record is unclear, as the authors were unable to identify the place name. Motono & Negishi (1989) listed *paradoxa* from Dan Sum in March and Nam Moh in July. Inayoshi (1996-2006) illustrated a male of form *telearchus* from Thabok (Tad Leuk Waterfall) caught on 2<sup>nd</sup> of April and a female collected at Phou Khao Khoay the day before. Phou Khao Khouay is on the northwestern side of the NBCA of the same name, which also includes the waterfalls at Thabok on the south side of the conservation area. Osada et al. (1999) pictured normal specimens of each form of the male, and an aberrant *danisepa* form with enlarged white markings almost reaching the submarginal area of the hindwing, all three collected at Thabok on 18<sup>th</sup> March 1996.

The female is only found as one form in Laos, which mimics the female of *Euploea mulciber*, with white spots on the duller blue forewing and white stripes across the hindwings. Both sexes of *paradoxa* are considerably larger than their models, but fly in a similar pattern to them. Males sit stationary at stream banks with their wings closed when drinking, and are usually seen during the middle of the day, unlike the *Euploea* species, which are common early in the morning and late afternoon. Females are normally only seen inside the forest, but occasionally venture into sunlit clearings and stream banks to feed on flowering trees. The female is rarely seen, and was most often found by the senior author inside the forest at Koun Kham valley, investigating a potential foodplant, which the senior author tentatively identified as *Machilus odoratissima* (Lauraceae)

from a photograph in Igarashi (1979). Koiwaya and Wakahara (1999) illustrated a pupa of *paradoxa* found at Thabok on 27<sup>th</sup> June 1997, which emerged on 19<sup>th</sup> August. They did not identify the foodplant, and the senior author has found that Wakahara is unfortunately not familiar with the Latin names of most plants.

This species occurs in at least three generations per year, with small numbers being found in-between the main emergences. The authors found this species to be common in Thabok in February-March, June and August, and also found it in Koun Kham valley from February to May. After May the authors were unable to enter the forest in the valley due to flooding, but found *paradoxa* in nearby Koun Ngun valley, which is dry outside the rainy season, as the streams feeding the valley off the surrounding limestone mountains run dry as soon as the rain stops. In August it was also occasionally recorded at slightly higher altitude of about 400 m in the forested slopes of Phou Pha Man, the mountain separating Koun Ngun from Koun Kham. The *mulciber* mimic, form *telearchus*, is by far the commoner, form *danisepa* only being found occasionally. This also reflects the relative incidence of the *Euploea* models, *mulciber* being much commoner than *radamanthus*.

### **Papilio agestor agestor** Gray, 1831

This species is found across the mountains of northern and central Laos, and has been recorded as far south as Lak Sao, although it is likely to occur in southern Laos since it is known from south Vietnam. It has only one brood per year, flying between January and April. It is found both at high altitudes and in lowland forest at the base of mountains, but is not known from Thabok, probably since the nearest high peak is some distance away. It is significant that the Danaine model of *agestor*, *Parantica sita* is also not found in Thabok. Dubois & de Salvaza (1921) first recorded *agestor* for Laos, citing as locality 'M. Em', the whereabouts of which Khamboun SP was unable to advise the authors. Motono & Negishi (1989) listed *agestor* from Vang Vieng in March, and Osada et al. (1999) pictured males from Phong Saly and Lak Sao caught in March and a female from Xam Neua collected in April. Khamboun SP has provided the author with specimens of *agestor* from Phou Phan, Xam Neua caught in March and April. The authors found *agestor* near the Vietnamese border east of Lak Sao,

as low as 550 metres, between late January and March, but found it to be uncommon there. Males sit on stream banks drinking water with wings flat parallel to the ground and forewings swept back over the hindwings in a totally different posture from other species of this group, which normally sit with wings closed. In flight it mimics the lazy skipping flight of *Parantica sita*, with similar crimson hindwings, looking identical until examined closely.

Wakahara (pers. comm.) has reared *agestor*, and stated that the larvae grow very quickly, from egg to pupa takes only about 20 days, but the adult does not emerge from the pupa until the following spring. He stated that *Papilio slateri* and *epycides* have a similar univoltine cycle, with a short larval period. Wakahara gave the senior author some photographs taken at 1700 metres on Phou Phan, Xam Neua, of the foodplant and a 5<sup>th</sup> instar larva of *agestor*. This foodplant has distinctive purple stems, and presumably is a species of Lauraceae. Wakahara stated that *agestor* will also feed on the plant identified as *Machilus odoratissima* by the senior author. Wakahara pointed this plant out as a foodplant of *agestor* to the author in forest south of Lak Sao. The larva is somewhat similar to that of *clytia*, black and white with tubercles, but the markings are quite different. Particularly notable are two yellow-green horns on the first thoracic segment over the head, and the black markings are actually black patches on a dark grey background. The tubercles are grey or white, with a pink spot at the base. Igarashi (1979) illustrated all the early stages on plate 105. The fifth instar larva pictured by Igarashi has much paler grey markings, and pale green replacing the white bands of the specimen in Wakahara's photographs. Whether this is individual or geographical variation is uncertain.

### ***Papilio slateri marginata* Oberthür, 1893**

*Papilio slateri* is smaller than any of the above species of the group, and like *agestor* and *epycides*, only flies in the dry season, between January and April. It is known from central Laos, but probably occurs in lowland forests throughout the country. Dubois & de Salvaza (1919) first recorded it in Laos, listing a specimen caught at Thado as form *jaintinus*. In their 1921 paper they add specimens of form *slateri* and *jaintinus* found in March 1919 at Ban-Sai. Motono & Negishi (1989) listed *slateri* from Vang Vieng and nearby Phatong in March.

Inayoshi (1996-2006) pictured a male from Thabok collected on 2<sup>nd</sup> April 1996, referring all mainland Southeast Asian populations to subspecies *slateri*. Osada et al. (1999) pictured four males all collected in March from Thabok and Lak Sao. The earliest that the present authors found *slateri* was in late January 2006, when they caught a single specimen in Koun Kham valley. They found more specimens there in March; in Thabok in February, early March and in April; and near the Vietnamese border east of Lak Sao in March and April. *Papilio slateri* is never common, only ever being seen in small numbers, and was found to be much rarer in Lak Sao than in lowland Thabok. Their flight is typical of the species group, slow and lazy, mimicking *Euploea*. Usually males can be found mud-puddling near streams in the forest during the middle of the day and afternoon, where they will sit with wings closed and legs extended as if on stilts. They can easily be distinguished from *Euploea* species by the bright yellow anal spot on the hindwing, which mimics the yellow coloured androconial scent brushes extruded by males of the model when disturbed.

In mainland Asia this species mimics *Euploea doubledayi*, which is a relatively small species, similar in size to *slateri*. *Papilio slateri* is quite variable across its range from northern India to Indochina, which has resulted in several subspecies being named. Hewitson (1856) named *slateri* based on type specimens from Darjeeling, where the specimens usually lack white spots on the outer discal region of the upperside of the hindwings, occasionally having these weakly indicated, but usually with the spots visible on the underside. Fruhstorfer [1903] described ab. *jaintinus* from two males from Assam in which the white discal spots are completely absent from both sides of the hindwings.

Butler (1882) described *tavoyanus* from Thoungyeen Valley, Tenasserim. The Thoungyeen [or Moei in Thai] River flows along the Thai-Burmese border in the Dawna Range of hills to join the Salween River, which then empties into the Andaman Ocean at Moulmein. Thus *tavoyanus* is found on the Burmese side of the hills separating Burma and Thailand; and these hills probably act as a barrier between *tavoyanus* and *marginata*, since *slateri* is confined to low elevation forest, rarely being seen above 500 metres. The type of *tavoyanus* in the Natural History Museum, London, has reduced blue discal stripes on the forewing and elongate white streaks on the hindwings, which are much longer than those of any specimens seen from Laos or mainland Thailand. There is a similar specimen in the

Rothschild Collection, ex Oberthür, labelled Tenasserim / Mäulmein / 1<sup>er</sup> Trim.1895 / Lakhat & Pamboo. Marshall (1882) also described *slateri* from Upper Tenasserim as *clarae*, from thirteen specimens from the same type locality and collector as Butler's specimen, and from nearby localities. The present whereabouts of Marshall's specimens are not known. Marshall gave a similar diagnosis for *clarae* as Butler, specifying the 'prominent row of pure white longitudinal streaks one on each side of each nervule leaving a wide brown margin beyond on which in some specimens indications of the continuation of the white streaks to the margin show through from the underside'. This suggests that *tavoyanus* is consistently different from *slateri* and *marginata*. Unfortunately for Marshall, his paper was published one month after Butler's, so *tavoyanus* has priority.

Oberthür (1893) described *marginata* from Nam-Ou, Entre Haut Tonkin & Laos. Nam Ou is the river flowing from the northernmost part of Laos through Phong Saly to join the Mekong north of Luang Phrabang, so it is clear that the type locality of *marginata* is in northern Laos. The type of *marginata*, examined by the authors, has more extensive blue marks on the forewing and shorter discal white streaks on the hindwing upperside than *tavoyanus*. Rothschild (1895) sank *clarae* and *marginata* as synonyms of *tavoyanus*, as did Fruhstorfer [1903]; but Jordan (1909) treated *marginata* and *tavoyanus* as separate subspecies from *slateri* and named a specimen of *marginata* without any white discal spots on the hindwing ab. *cnephas*. Both *jaintinus* and *cnephas* are infrasubspecific, so have no nomenclatorial status under the ICZN Code, and at most can be regarded as forms. Tytler (1939) considered *tavoyanus* and *marginata* as distinct subspecies, and recorded six specimens from Karen Hills, Burma as belonging to *tavoyanus*, not *marginata*. Talbot (1939) and subsequent authors, such as Igarashi (1979), d'Abrera (1982) and Pinratana & Eliot (1992) have followed Jordan (1909), except Tsukada & Nishiyama (1982) who regarded *marginata* as a form of the nominate subspecies but separated *tavoyanus* as a valid subspecies. At that time Laos was effectively a closed country, and very few examples from there were available for study.

Osada et al. (1999) effectively synonymized the subspecies of *slateri* when they pictured what they refer to as four forms on plate 6, and used subspecies *slateri* in their checklist on page 200. Inayoshi (1996-2006) also regards all mainland Asian *slateri* as belonging to

subspecies *slateri*, which he stated to the senior author (pers comm.) was his personal opinion, rather than following any published work. Of the four specimens pictured by Osada et al. (1999) they incorrectly named the top left specimen form *perses* de Nicéville, 1894, which is actually a good subspecies found in South Thailand, the Malay Peninsula and Sumatra. That subspecies lacks the blue discal stripes on the forewing found in mainland Asian subspecies of *slateri*, and mimics the small species of *Euploea* there, *eyndhovii*, which has a brown forewing without a dark blue metallic sheen. The specimen referred to as *perses* is typical of the variation within *marginata*, as are the two specimens at the bottom of the group of four. The left hand one of these is labelled f. *tavoyana*, but it is clearly just a specimen of *marginata* with larger white spots, unlike true *tavoyanus*, which has these spots discally extended into streaks and a reduction of the blue markings of the forewing. The specimen at top right, which lacks white discal streaks on the hindwing upperside, is named as form *slateri* and is an example of Jordan (1909)'s ab. *cnephas* which is rare in Laos, all Lao specimens of *slateri* seen by the present authors are typical *marginata*, with some variation in the amount of white on the hindwings. Specimens of ab. *cnephas* are known to the authors from various localities in Thailand, but are always much less common than form *marginata*, unlike in India where most specimens of *slateri* have plain brown uppersides of the hindwings, occasionally with indications of white discal marks, but not well developed as in *marginata* or *tavoyanus*. All specimens so far known from Thailand above the Isthmus of Kra are either ab. *cnephas* or *marginata*, and the specimen pictured as *tavoyana* on Plate 20 of Pinratana & Eliot (1992) is also *marginata*. The present authors therefore follow Jordan (1909) and subsequent authors in separating *marginata* and *tavoyanus* as distinct subspecies from *slateri*.

*Papilio slateri marginata* is quite variable in the size of the white outer discal spots of the hindwing. As stated above, specimens are known without any white markings at all on the upperside, some of which retain the white spots on the underside; and there are occasional specimens with small spots on the upperside, but these always have well-developed spots on the underside. Each space in the hindwing has a white spot either side of the vein, which is always dark brown. The spots in the same space often fuse with each other, but usually retain at least a narrow stripe of brown scales between

them. Sometimes on the upperside there is an additional small row of submarginal white dots between the discal spots and the margin; whereas on the underside the discal spots are normally extended to the submarginal area near the veins, but do not quite reach the brown margin. The authors have not seen any females from Laos, but those from Thailand and Vietnam are similar to the male, except a little larger with slightly more rounded wings.

### ***Papilio epycides hypochra* Jordan, 1909**

This is the smallest species of the group, and is mimetic of the common Danaine *Parantica aglea* in Laos, usually occurring in the same localities as *Papilio agestor* at the same time of year. Dubois & de Salvaza (1921) first recorded *epycides* in Laos, from “M. Em”. Osada et al. (1999) pictured a pair from Phong Saly collected in March and April and two melanic males from Lak Sao caught in February and March. Khamboun SP provided the senior author with a series of specimens from Phou Phan, Xam Neua, collected between mid February and early May. Wakahara also gave the senior author some males from Nam Cha, Xaysomboun, caught at the end of February. The present authors found *epycides* near the Vietnamese border east of Lak Sao in February and March, and, as with *agestor*, did not find it at the other localities investigated.

Jordan (1909) described subspecies *hypochra* thus: ‘The ♂ as light as light ♀♀ from Assam and Sikkim, the 3 grey discal stripes on the forewing above, which are placed between the lower angle of the cell and the 2. median, distally twice as broad as the black vein-stripes; the costal margin of the forewing, especially beneath, more narrowly black than in *epycides*-♂♂, and the under surface of the hindwing before the cell with a long, broad white-grey stripe, which extends almost to the submarginal spot, the costal margin from the base to the middle likewise white-grey. One ♂ from the Shan States and another from the Karen Mountains (Salwin River) in the Tring Museum.’

Subspecies *hypochra* is similar to the nominate subspecies from India, which looks darker, due to the presence of scattered brown scales on the pale stripes on both wings of subspecies *epycides*. The subspecies from Kachin State, Burma, *curiatus* Fruhstorfer, 1901 is darker still, approaching those from Sichuan, named *horatius* Blanchard, 1871. The melanic specimens of *hypochra* pictured by

Osada et al. (1999) were collected near the Vietnamese border at Lak Sao. The senior author took Vadim Tshikolovets there in early March 2005 and mid February 2006, and Tshikolovets explored the forest up a branch of the stream at 660 metres altitude, whereas the author stayed in the open area near the main stream at the same altitude. In both years Tshikolovets collected melanic individuals inside the forest there, and the author only collected two slightly darker than normal specimens. In March 2006 the author caught a few *epycides* at the same locality and at another location two kilometres downstream and 100 metres lower, which was also an open, sunny stream bank. All the specimens collected in March 2006 were typical *hypochra*, not at all melanic. It seems that the melanic specimens, some of which have almost completely black forewings with just submarginal spots remaining, prefer to stay inside the forest. This melanism has not been noticed elsewhere in Laos or in Thailand, and needs further investigation. Possibly it is caused by the unusual fluctuations in temperature at this point on the Vietnamese border, where the weather is very changeable, and cool mist and rain can often come in from Vietnam for several days at a time during the dry season. This is due to these hills being the first range in close proximity to the South China Sea, and the Nam Phao border pass seems particularly susceptible. The senior author recorded the maximum daytime temperature as only 17°C one day during such weather in early March 2005. It is of note that the lower collecting point where melanic specimens were not found has slightly better weather, often still being sunny when the border, further up the same valley, is shrouded in mist.

Wakahara (pers. comm.) reared the larva of *epycides* from Laos, and gave the senior author some photographs. Wakahara said the larval stage is very short, as in *agestor* and *slateri*, and *epycides* feeds on the same host plants, in the family Lauraceae. He pointed out that these larvae are very different from the Taiwanese specimens illustrated by Igarashi (1979), which have a smooth-skinned fifth instar. The colour and pattern of the fifth instar larva from Laos is the same, yellowish green with similar black markings and rows of blue spots, but the larvae from Laos have two rows of long spiny tubercles protruding from the blue spots on the dorsal surface. These tubercles are blue at the base and sides with black tips. The authors have not found any other references in the literature to the larva of *epycides*, so cannot draw any conclusions about the observed differences.

**Papilio epycides imitata** (Monastyrskii & Devyatkin, 2003) **stat. nov., comb. nov.**

Monastyrskii & Devyatkin (2003) described *imitata* as a new species of *Chilasa* Moore, [1881] from Bi Doup–Nui Ba Nature Res., Dong Mang District, Lam Dong Province, C. Vietnam. The senior author has examined the male holotype and a female paratype in the collection of the Natural History Museum, London. Monastyrskii & Devyatkin (2003) clearly state that the only reason they separate this taxon at specific level is the unusual colour of the hindwing, without the orange tornal spot found in all other subspecies of *epycides*. Since they state that the size of specimens and the male genitalia are identical to those of *epycides*, and *imitata* is not sympatric with *epycides*, the authors place *imitata* as a subspecies of *epycides*; and, as stated at the start of the annotated checklist, place the genus *Chilasa* as a synonym of subgenus *Pterourus* Scopoli, 1777. Thus the correct name for this taxon is *Papilio epycides imitata* (Monastyrskii & Devyatkin, 2003) **stat. nov., comb. nov.**

Wakahara (pers. comm.) reports that he has found this taxon in Laos near the Vietnamese border in Xe Xap NBCA, north Sekong Province, in late February 2000, but the authors have not seen any specimens from Laos as the specimens had been sent to Japan, so are unable to positively confirm their identity. It is unlikely that Wakahara would mistake this subspecies for *hypochra* since the hindwing is noticeably different.

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## RIASSUNTO

*Lista preliminare annotata dei Papilionidae del Laos, con note sulla tassonomia, fenologia, distribuzione e variazione (Lepidoptera, Papilionoidea).*

È presentata una lista di 63 taxa di Papilionidae del Laos che rappresentano 60 specie biologiche. Tra questi, la presenza di *Papilio elephenor* non è ancora comprovata e quella di *Papilio krishna* è confutata lasciando quindi 58 specie confermate per il Laos. Vengono fornite note sulla tassonomia, distribuzione, fenologia e variabilità di ogni singola specie e proposte le seguenti sinonimie o nuove combinazioni:

*Graphium antiphates itamputi* è considerata una sottospecie differente da *pompilius* **stat. rev.**

*Papilio tamerlanus timur* Ney, 1911 è un sinonimo di *Papilio alebion mullah* Alphéraky, 1897, **syn. nov.** Vengono proposte quindi le seguenti combinazioni per la specie collettiva: *Graphium mullah mullah* (Alphéraky, 1897) **comb. nov.** rappresenta le popolazioni del Sichuan; *Graphium mullah chungianus* (Murayama, 1961) **comb. nov.** quelle di Taiwan; e *Graphium mullah kooichii* (Morita, 1996) **comb. nov.** la sottospecie Laotiana.

Il vero olotipo di *Papilio arycles sphinx* Fruhstorfer, 1899 è identificato e *arycleoides* Fruhstorfer, 1902 ne è considerato un sinonimo, **syn. nov.**

*Teinopalpus imperialis bhumipoli* Nakano & Sukkit, 1985, *T. i. gerritesi* Nakano, 1995, *T. i. gillesi* Turlin, 1991, e *T. i. hakkaorum* Schäffler 2004, vengono considerati sinonimi di *Teinopalpus imperialis imperatrix* de Nicéville, 1899, **syn. nov.**

*Atrophaneura varuna liziensis* Zhao, 1997 è sinonimizzato con *A. varuna astorion* (Westwood, 1842) **syn. nov.**

I taxa nominali *elegans* Chou et al., 2000, *pulcher* Chou et al., 2000 e *longimacula* Wang & Niu, 2002 sono considerati sinonimi di *Papilio bianor bianor* **syn. nov.**

Lo status di *Papilio bianor significans* Fruhstorfer, 1902 viene discusso, la sottospecie ritenuta valida (**stat. rev.**) e gli areali di *Papilio bianor gladiator* Fruhstorfer, [1902] e *ganesa* Doubleday, 1842 vengono ridisegnati.

*Papilio noblei* de Nicéville, [1889] è considerato monotipico e *haynei* Tytler, 1926 viene sinonimizzato, **syn. nov.**

*Papilio hipponous siamensis* Godfrey, 1916 è sinonimizzato con *pitmani* Elwes & de Nicéville, [1887] **syn. nov.**

Il taxon *imitata* Monastyrskii & Devyatkin, 2003 è considerato conspecifico con *Papilio epycides* e quindi la combinazione che viene proposta è *Papilio epycides imitata* **stat. nov., comb. nov.**

## SUMMARY

63 Papilionid taxa of Laos are reported representing 60 biological species. Of these, the occurrence of *Papilio elephenor* is unproven, and that of *Papilio krishna* is refuted, leaving 58 species confirmed for Laos. Notes on their taxonomy, distribution, phenology and variation are given.

The following synonymies or changes of status are herewith listed:

*Graphium antiphates itamputi* is regarded as a separate subspecies from *pompilius* **stat. rev.**

*Papilio tamerlanus timur* Ney, 1911 is a synonym of *Papilio alebion mullah* Alphéraky, 1897, **syn. nov.** The following combinations are therefore proposed for the collective species: *Graphium mullah mullah* (Alphéraky, 1897) **comb. nov.** applies to the Sichuan population; *Graphium mullah chungianus* (Murayama, 1961) **comb. nov.**, for the Taiwanese subspecies; and *Graphium mullah kooichii* (Morita, 1996) **comb. nov.** for the Lao subspecies.

The true type of *Papilio arycles sphinx* Fruhstorfer, 1899 is identified, and *arycleoides* Fruhstorfer, 1902 placed in synonymy, **syn. nov.**

*Teinopalpus imperialis bhumipoli* Nakano & Sukkit, 1985, *T. i. gerritesi* Nakano, 1995, *T. i. gillesi* Turlin, 1991, and *T. i. hakkaorum* Schäffler 2004 are shown to be synonyms of *Teinopalpus imperialis imperatrix* de Nicéville, 1899, **syn. nov.**

*Atrophaneura varuna liziensis* Zhao, 1997 is synonymized with *A. varuna astorion* (Westwood, 1842) **syn. nov.**

The names *elegans* Chou et al., 2000, *pulcher* Chou et al., 2000 and *longimacula* Wang & Niu, 2002 are sunk as synonyms of *Papilio bianor bianor* **syn. nov.**

*Papilio bianor significans* Fruhstorfer, 1902 is regarded as a valid subspecies (**stat. rev.**) and the ranges of *Papilio bianor gladiator* Fruhstorfer, [1902] and *ganesa* Doubleday, 1842 are clarified.

*Papilio noblei* de Nicéville, [1889] is shown to be monotypic, and *haynei* Tytler, 1926 is sunk as a synonym **syn. nov.**

*Papilio hipponous siamensis* Godfrey, 1916 is synonymized with *pitmani* Elwes & de Nicéville, [1887] **syn. nov.**

The taxon *imitata* Monastyrskii & Devyatkin, 2003 is considered conspecific with *Papilio epycides* and therefore the combination is *Papilio epycides imitata* **stat. nov., comb. nov.**

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