

# Observations on the biology of *Pelopidas thrax* (Hübner) (Lepidoptera: Hesperiiidae: Hesperinae) in the Hajar Mountains, Oman

by Matthew J.W. Cock

## Summary

*Pelopidas thrax* (Hübner) - the Millet Skipper- is a widespread skipper butterfly found throughout sub-Saharan Africa, Cyprus, Egypt and the Middle East to Pakistan. The published information on the food plants and early stages is critically reviewed. Caterpillars and pupae collected on *Saccharum kajkaiense* (Melderis) Melderis (Poaceae) in the Hajar Mountains, Oman, are described and illustrated. Differences from the published accounts are discussed. A specimen captured in Dubai may be the first record of this species from the United Arab Emirates.

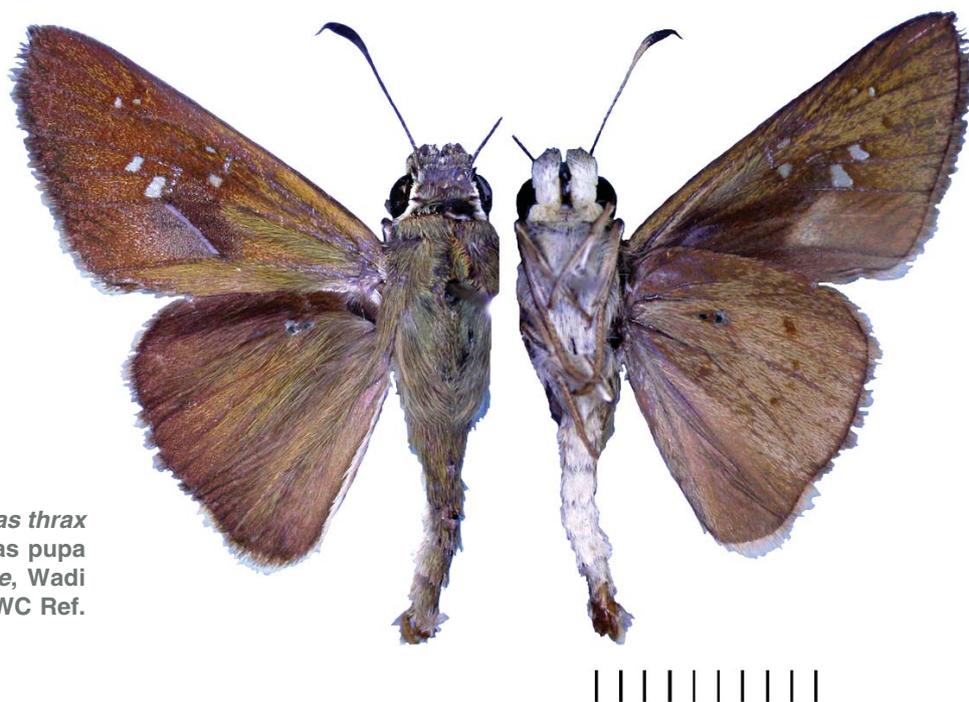


Fig 1. Adult male *Pelopidas thrax* (scale in mm), collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200B).

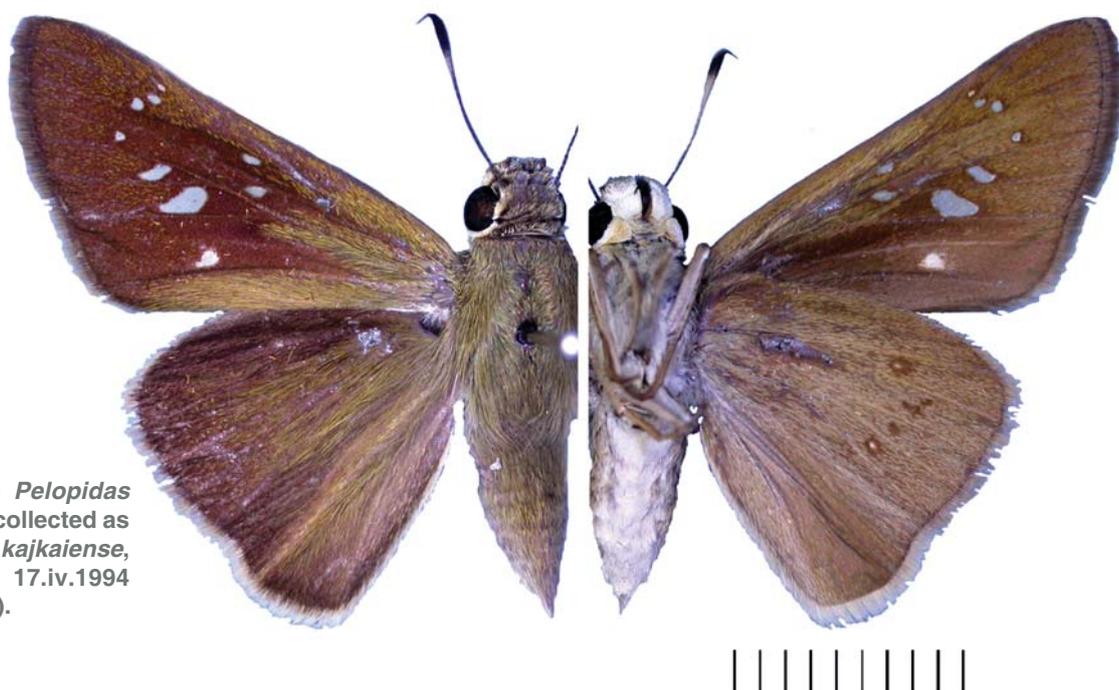


Fig 2. Adult female *Pelopidas thrax* (scale in mm), collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200A).

## Introduction

*Pelopidas thrax* (Hübner) (**Figs. 1-2**) is a widespread skipper butterfly found throughout sub-Saharan Africa, Cyprus, Egypt and the Middle East to Pakistan and North-west India (Evans 1937, 1949; Larsen 2002, 2005). Until recently, it was treated as two separate subspecies: the nominate *thrax*, described from Syria, and found in Cyprus and from Egypt to North-west India (Evans 1937, 1949; Larsen 2002); and subspecies *inconspicua* (Bertolini), described from Mozambique and found throughout sub-Saharan Africa (Evans 1949; Dickson and Kroon 1978; Larsen 2005). However, Larsen (2005) examined adult material from throughout this range and concluded that Evans (1937, 1949) incorrectly treated *thrax* as an extreme dry season form, exemplified by specimens from Iraq. He concluded that *P. thrax* is a single subspecies throughout its range and accordingly, he synonymised *inconspicua* under *thrax*.

There are no supporting observations for or against this conclusion based on early stages, so observations and comparison of material of the two former sub-species would be useful.

*Pelopidas thrax* is similar to the even more widespread *P. mathias* (Fabricius). The two species are quite easily distinguished as adult males: *P. thrax* (**Fig. 1**) having a grey-white brand on the upper forewing, whereas *P. mathias* has a black brand. The females are rather similar and separation may cause difficulty. The early stages have not been compared hitherto.

Both these *Pelopidas* species are found in the Arabian Peninsula (Larsen 1984). *Pelopidas thrax* is known from northern Oman (Rostaq, Wadi Sahtan), but probably also occurs in Dhofar and Musandam (Larsen & Larsen 1980). Similarly, *P. mathias* occurs in Dhofar, Rostaq and Musandam (Khasab) (Larsen & Larsen 1980). Brown (1992) includes only *P. mathias* in his interim list "Butterflies of the United Arab Emirates". Gillett (1995) includes both species in his annotated list of butterflies recorded from the UAE and the Buraimi – Al Mahdah region of Oman, noting that *P. thrax* is regularly found in the plantations around Mahdah, but not yet observed in the Al Ain area.

In sub-Saharan Africa, *P. thrax* is a species more associated with forests than grassy areas. Thus, Henning *et al.* (1997) state that it is "an inhabitant of woodland and forest margins ... only occasionally in grass-, thorn-, or bushveld .... More often found in dense rain forests" in southern Africa. However, also writing about southern Africa, Dickson & Kroon (1978) only associated it with grassy areas. Larsen (1991), writing about the situation in Kenya, found that *P. thrax* "tends to be less well adapted to the more arid parts of the country" than *P. mathias*. Writing about West Africa, he states that *P. thrax* is "more frequently found in the forest zone than *P. mathias*, occasionally even in actual forest" (Larsen 2005). I have personally collected this species in Uganda (Mabira Forest) and Côte d'Ivoire (Adiopodoumé) in forested areas, supporting the observations above. I have also found it common in Pakistan at Rawalpindi in a suburban situation, where the original vegetation was probably light forest. In the Arabian Peninsula, *P. thrax* is reported as a species of oases and plantations (Larsen

1984; Gillett 1995).

The reported food plants of *P. thrax* are all grasses, but almost all published records seem to be secondary sources, and I have failed to track down many original food plant records. For example, it has been reported several times as a pest of rice, yet Heinrichs & Barrion (2004) do not mention this species in their comprehensive review of rice pests in West Africa, although they do include *P. mathias*, which is well recognised as a minor pest of rice (e.g. IRRI 1983).

The food plant records from the Arabian Peninsula are limited. Larsen & Larsen (1980) give "grasses, including rice, wheat and millet", but this is probably based on sources from outside the region. Larsen's (1984) illustration of a caterpillar on a millet leaf is misidentified (see discussion below).

Dickson & Kroon (1978), presumably based on the notes of G.C. Clark from South Africa, give the food plant as *Imperata cylindrica* (L.) Raeusch. (as *I. arundinacea*), and add that it was reared on *Ehrharta erecta* Lam. and other grasses. Pringle *et al.* (1994) in the revision of Dickson & Kroon (1978) imply that *E. erecta* is a food plant, but this is probably based on the rearing food plant record from the earlier edition. Larsen (1991) reports that the caterpillars feed on grasses (*Ehrharta*, *Oryza*, *Imperata*) and it may be a minor pest of rice. Larsen (2005) expands this to a "wide array of Poaceae, including *Oryza*, *Ehrharta* and *Imperata*".

The possibility of confusion between the two *Pelopidas* spp. suggests that all records not based on reared voucher specimens are open to question.

As far as I can tell, of those mentioned above, the only unequivocal field record of a food plant for *P. thrax* is G.C. Clark's South African record on *I. cylindrica*.

Clark (1978) provides excellent paintings of the life history on "grass" (Dickson & Kroon 1978, Plate 32). The egg, all caterpillar instars and pupa are shown in dorsal and lateral view. The final instar caterpillar is pale yellow-brown, with a darker dorsal line and a brown lateral line. The head is pale brown, the posterior margin and lateral areas dark, as are the epicranial and clypeal sutures. The earlier instars are similar, but the head is dark. The pupa is slender, pale yellow-brown, with a slightly downturned, dark, frontal spike, and the proboscis sheath projecting about one segment beyond the wing cases.

Makris (2003) illustrates a caterpillar of *P. thrax* from Cyprus, which is very similar to that illustrated by Clark (1978). The head is shown almost in lateral view, but with a slight anterior perspective. It is light brown with a very strong lateral stripe, which extends at least partly to the posterior margin; the epicranial suture and some or all of the adfrontals and clypeus are black, and there is a trace of a black streak extending dorsally on the epicranium from the adfrontals.

The main purpose of this paper is to document the life history and a food plant of *P. thrax* in the Hajar Mountains, Oman, in order to contribute to understanding the biology of this species and the better understanding of the fauna of the region. However, it also provides an opportunity to record the capture of a male specimen at Dubai (Jumeirah) on 9th April 1992. Larsen (1984), Brown (1992) and Gillett (1995) do not include the UAE in the distribution of this species, but it is not unexpected.



Fig 3. Wadi Khamees with a large tuft of *Saccharum* sp. in the foreground.



Fig 4. Edge of wadi with two plants of *Saccharum kajkaiense*.

## Localities

Two wadis were visited in the area South-east of Hatta in November 1992 and April 1994. To reach them, take the road south past the Hatta Pools and past a sign for Wadi Khamees. The road follows Wadi Qilifi south-south-west for several kilometres, and Site 1 is Wadi Dainah, the only large wadi to the left with high walls and a lot of green vegetation. Following the road for several more kilometres, it goes over a small pass and comes to a village; Site 2 is the next wadi on the left after the village. For my specimen data labels, both areas are referred to as Wadi Khamees, for lack of more authoritative information at the time. Both localities are on the Oman side of the border with the UAE, based on road signs and maps.

## Observations

What I assumed to be a single species of tussock forming grass was present, in the wadi bed of both sites, both as large plants (**Fig. 3**) and small plants, the latter particularly along the edge of the wadis at the foot of the side wall (**Fig. 4**). My herbarium specimen was identified as *Saccharum kajkaiense* (Melderis) Melderis (Poaceae) by T. Cope of the Royal Botanic Gardens, Kew, who commented that it is very local in Oman and also known from Iran and Afghanistan. However, there may have been two species of grass present as the large tussock grass found in wadis is locally known only as *S. ravennae* (L.) L. (Jongbloed 2003). In the following, I refer to all food plants as *S. kajkaiense*, while recognising that I cannot say now whether my observations were only from *S. kajkaiense*, or from both *Saccharum* spp.

Eight caterpillars of several different instars were found 23rd November 1992 at Site 1 (MJWC Ref.

92/210), on *S. kajkaiense*, and I was able to rear one through to an adult female. I was not successful in rearing the remaining caterpillars, as I ran out of fresh food plant material, and, although the caterpillars accepted another grass, *Rottboellia cochinchinensis* (Lour.) Clayton, they all died before pupating. On 17th April 1994, two caterpillars and two pupae were collected from Site 1 and Site 2 (MJWC Ref. 94/200). At this time, many (10-20) empty pupae were also found. From the April 1994 collections, I successfully reared a male and female. The following account includes details from both collections, the description of earlier instars based on the first, and the description of the final instar and pupa mostly based on the second.

The caterpillars seemed to be found on the more isolated small plants of *S. kajkaiense*, and in April 1994 I noted that they seemed to be particularly associated with the north or north-east side of the wadi.

The caterpillars rest in shelters formed from the leaves of the food plant. Small caterpillars make a shelter from a single leaf, by rolling the edges upwards until they meet, and holding the edges together with strands of silk. They then feed from the edge of the leaf lamina distally or basally to the shelter, or both. Larger caterpillars draw together several leaves and hold the edges together with silk strands to form a tube.

No ova were found. Detailed observations on and photographs of the early stages were not made, but the head capsules were preserved (**Fig. 5**), and the following account of the early stages is based on these. Head capsules were measured using a binocular microscope with an eyepiece graticule, accurate to  $\pm 0.05$ mm for instars 1-4, and  $\pm 0.07$  for instars 5-6. There seem to be consistently six larval instars with variable intensity of markings (**Fig. 5**, Table 1), although more material and sequential observation would be useful to confirm this.



**Fig 5.** Head capsules of *Pelopidas thrax*, instars 1-6, collected on *Saccharum kajkaiense*, Wadi Khamees, 23.xi.1992 and 17.iv.1994. The instar 6 head capsule contains the dried remains of the dead caterpillar, and so is darker than in life (cf. **Figs. 6-8**). For dimensions see Table 1.

**Table 1. Dimensions and colouring of head capsules of caterpillars of *Pelopidas thrax* collected on *Saccharum kajkaiense*, Wadi Khamees, 23.xi.1992 and 17.iv.1994.**

Instar	n	Width (mm)	Height (mm)	Colour
1	2	1.0-1.1	1.1-1.2	Uniformly dark.
2	4	1.5-1.6	1.6-1.7	Three are light brown with narrow dark lateral lines, epicranial suture and adfrontal sutures, but one is darker brown, with strong dark lateral line and epicranial suture, adfrontals and clypeus dark.
3	2	1.8-2.0	2.0-2.1	One light, with thin dark lateral line and epicranial suture, and adfrontals and clypeus dark; the other dark brown with thick dark lateral line and epicranial suture, and adfrontals and clypeus dark.
4	3	2.1-2.4	2.3-2.5	Two light brown with narrow lateral dark line, epicranial suture and adfrontal sutures; one dark brown, with thick dark lateral line and epicranial suture, and adfrontals and clypeus dark.
5	4	2.4-2.7	2.7-3.1	All light brown, with dark lateral line varying from (1) very narrow not extending as far as the vertex, (2) very narrow extending to vertex, (3) medium strong, (4) strong; narrowly dark epicranial suture and adfrontal sutures.
6	4	3.3-3.6	3.4-4.1	Pale brown, two with only a trace of the dark lateral line above the ocelli, one with no dark lateral line at all, and one with strong line stopping well short of apex; epicranial suture may or may not be dark, adfrontal sutures not dark. Other caterpillars (e.g. Figs. 6 & 8) show a strong lateral line extending to vertex, or the epicranial suture almost unmarked (Fig. 7).

The sixth instar caterpillars (**Figs 6-8**) grow up to 35mm long. Body dull pale green; dorsal line darker; sub-dorsal and lateral pale stripes. Spiracles pale, inconspicuous; all legs concolorous. Wax glands formed ventro-laterally on the anterior margin of abdominal segments 7 and 8 when caterpillar mature.



**Fig 6. Sixth instar caterpillar of *Pelopidas thrax*, approx. 35 mm, collected on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200C).**



Fig 7. Head of sixth instar caterpillar of *Pelopidas thrax* with reduced dark markings (about 3.5mm wide), collected on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200D).



Fig 8. Head of sixth instar caterpillar of *Pelopidas thrax* with strong markings (about 3.5mm wide), collected on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200C).

Pupa (**Fig. 9**) 32 mm long; elongate, with a frontal spike of about 3 mm, pointed slightly upwards; yellowish white; slightly paler sub-dorsal line. The pupa is formed in the shelter of the mature caterpillar, which is lined with silk. The inside of the shelter is covered with a thin deposit of white waxy powder, which is not found on the pupa itself.



Fig 9. Pupa of *Pelopidas thrax* (approx 32mm long) collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200B).

In captivity, adults (**Figs. 10-11**) emerged after 6-13 days from pupae collected in the field.



Fig 10. Newly emerged male *Pelopidas thrax*, collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200B).



Fig 11. Newly emerged female *Pelopidas thrax*, collected as pupa on *Saccharum kajkaiense*, Wadi Khamees, 17.iv.1994 (MJWC Ref. 94/200A).

One caterpillar in the fifth instar, collected in November 1992, had been parasitised by a gregarious eulophid parasitoid. Seven female and three male adult wasps were reared from the associated black pupae, but have not been identified. Another caterpillar collected in the fifth instar produced a tachinid larva in the sixth instar which formed a puparium 3.4 x 7.2 mm diameter x length, which failed to emerge.

In view of the presence of *P. thrax* at Sites 1 and 2, in Oman but only a few kilometres from the UAE border, it seems reasonable to expect that the butterfly and its food plant are also present in suitable habitat within that part of the Hajar Mountains lying within the UAE, at least in the Hatta / Huwaylat area.

The separate capture of a specimen in coastal Dubai at Jumeirah (Jumeirah Villas) on 9th April 1992 was in typical garden habitat with mostly exotic plant species, including flowering plants. It was at rest when found, and so I cannot report any observations of adult feeding or early stages.

## Discussion

Although the available reports from sub-Saharan Africa indicate this is mostly a species associated with forests, and generally not associated with arid areas, these observations from wadis of the Hajar Mountains show that *P. thrax* is able to live and breed on a specialised grass in the generally dry wadi habitat as well as plantations and oases, as noted by Gillett (1995) and Larsen (1984) in Oman. The single record from coastal Dubai is difficult to interpret in isolation; it probably

represents a specimen that had dispersed from its normal habitat and breeding area, but the possibility of a breeding population cannot be ruled out.

Comparing my pictures and descriptions with those of Clark (1978) from southern Africa and Makris (2003) from Cyprus, in the final instar the Oman material has a very much less strongly marked head capsule. Moreover, whereas the head capsules of all the early instars illustrated by Clark (1978) are black, those of the Oman material are variably pale with more or less pronounced black markings.

The pupa from Oman clearly differs from that illustrated by Clark (1978) in that the frontal spike of the former is concolorous with the rest of the pupa and slightly upturned, whereas in the latter it is dark and slightly down turned.

However, the caterpillar illustrated as *P. thrax* by Larsen (1984) is obviously different, having a green head, with a red-brown line running from the epicranial suture at the dorsum, laterally to the ocelli, and an adjacent white stripe anterior to this. It is actually the final instar caterpillar of *P. mathias*. I have reared *P. mathias* in Kenya and Zimbabwe but have not yet published these observations. I have found very little published on the life history and very few published pictures of the early stages, which is surprising since it is a recognised pest. IRRI (1983) illustrate a caterpillar comparable with my rearing, but the pupa illustrated is incorrectly associated as it has no frontal spike, whereas the pupa of *P. mathias*, like that of *P. thrax*, has a frontal spike. It seems likely that the pupa illustrated is that of *Parnara guttata* (Bremer & Grey), another hesperiid pest of rice in Asia.

The *Pelopidas mathias* caterpillars that I have reared and the one illustrated by IRRI (1983) both match the caterpillar illustrated as *P. thrax* by Larsen (1984). T.B. Larsen (*pers. comm.* 2008) did not rear that caterpillar, which he found in Dhofar and assumed to be *P. thrax*, because of the food plant, and, as far as he knew at that time, *P. mathias* did not occur in the area. Thus, it seems safe to conclude that Larsen's (1984) illustration is of *P. mathias*, and the specific food plant association of millet relates to that species and not *P. thrax*.

My adult specimens from the UAE and Oman are certainly larger and more fulvous than those I have seen from elsewhere, but I have not examined enough material from different localities and different seasons to suggest that Larsen's (2005) monotypic treatment of *P. thrax* is incorrect. However, the differences noted in the caterpillars and pupae suggest that the Oman population, at least with regards to the early stages, may not fit into the concept of *P. thrax* as a monotypic species; the possibility of subspecies or a complex of similar species cannot be ruled out. Several recent studies have shown that cryptic species pairs or groups exist which can be separated by their caterpillars and food plants and by bar-coding, but are very similar as adults, both in appearance and in genitalia (Hebert *et al.* 2004; Burns *et al.* 2007, 2008). *Pelopidas thrax* would seem a worthwhile subject for similar study, based on life history information and the use of DNA techniques.

## Acknowledgements

The grass, *Saccharum kajkaiense*, was identified by T. Cope of the Royal Botanic Gardens, Kew. Torben Larsen clarified his experience with the *Pelopidas* caterpillar illustrated in Larsen (1984) and sent me a copy of the illustration in Makris (2003). Gary Feulner reviewed a draft of this paper, providing useful adjustments to the locality information and we had a valuable discussion of the grass species involved. Sami and Brian Wilkie of Dubai provided company and transport for the two collecting trips.

## References

Brown, J.N.B. (1992) Butterflies of the United Arab Emirates. **Tribulus** 2:1, 10-11.

Burns, J.M., Janzen, D.H., Hajibabaei, M., Hallwachs, W., Hebert, P.D.N. (2007) DNA barcodes of closely related (but morphologically and ecologically distinct) species of skipper butterflies (Hesperiidae) can differ by only one to three nucleotides. **Journal of the Lepidopterists' Society** 61, 138-153.

Burns, J.M., Janzen, D.H., Hajibabaei, M., Hallwachs, W., Hebert, P.D.N. (2008) DNA barcodes and cryptic species of skipper butterflies in the genus *Perichares* in Area de Conservación Guanacaste, Costa Rica. **Proceedings of the National Academy of Sciences of the United States of America** 105, 6350-6355.

Clark, G.C. (1978) Life cycles. Life histories of South African hesperiid butterflies. Pp. 205-281 (plates 1-38) in Dickson, C.G.C., Kroon, D.M. (1978).

Dickson, C.G.C., Kroon, D.M. (eds.) (1978) *Pennington's butterflies of southern Africa*. A.D. Donker;

Johannesburg, South Africa, 670 pp.

Evans, W.H. (1937) *A catalogue of the African Hesperidae indicating the classification and nomenclature adopted in the British Museum*. British Museum (Natural History); London, UK, 212 pp., 30 plates.

Evans, W.H. (1949) *A catalogue of the Hesperidae from Europe, Asia and Australia in the British Museum (Natural History)*. British Museum (Natural History); London, UK, 502 pp., 53 plates.

Gillett, M.G. (1995) An updated and annotated list of butterflies recorded from the UAE, and the Buraima – Al Mahdah region of Oman. **Tribulus** 5:2, 16-20.

Hebert, P.D.N., Penton, E.H., Burns, J.M., Janzen, D.H., Hallwachs, W. (2004) Ten species in one: DNA barcoding reveals cryptic species in the neotropical skipper butterfly *Astraptes fulgerator*. **Proceedings of the National Academy of Sciences of the United States of America** 101, 14812-14817.

Heinrichs, E.A., Barrion, A.T. (2004) *Rice-feeding insects and selected natural enemies in West Africa: Biology, ecology, identification*. International Rice Research Institute; Los Baños, Philippines, and WARDA–The Africa Rice Centre; Abidjan, Côte d'Ivoire, 243 pp.

Henning, G.A., Henning, S.F., Joannou, J.G., Woodhall, S.E. (1997) *Living butterflies of Southern Africa. Biology, Ecology and Conservation. Volume 1 Hesperidae, Papilionidae and Pieridae of South Africa*. Umdaus Press; Hatfield, South Africa, 395 pp.

IRRI (International Rice Research Institute) (1983) *Field problems of tropical rice. Revised Edition*. International Rice Research Institute; Los Baños, Philippines, 172 pp.

Jongbloed, M. (2003) *The Comprehensive Guide to the Wild Flowers of the United Arab Emirates*. Environmental Research and Wildlife Development Agency (ERWDA), Abu Dhabi, 576 pp.

Larsen, T.B. (1984) *Butterflies of Saudi Arabia and its neighbours*. Transworld Arabian Library, Riyadh & Stacey International, London, 160 pp.

Larsen, T.B. (1991) *The butterflies of Kenya and their natural history*. Oxford University Press; Oxford, UK, 490 pp.

Larsen, T.B. (2002) The butterflies of Delhi, India – an annotated check-list. **Esperiana** 9, 459-479.

Larsen, T.B. (2005) *Butterflies of West Africa*. 2 vols. Apollo Books; Stenstrup, Denmark, 595 + 270 pp.

Larsen, T., Larsen, K. (1980) *Butterflies of Oman*. John Bartholomew & Son Ltd.; Edinburgh, UK, 80 pp.

Makris, C. (2003) *Butterflies of Cyprus*. Bank of Cyprus; Nicosia, Cyprus, 329 pp.

Pringle, E.L.L., Henning, G.A., Ball, J.B. (eds.) (1994) *Pennington's butterflies of Southern Africa*. Struik Winchester; Cape Town, South Africa, 800 pp.

**Matthew J.W. Cock**  
CABI Europe - Switzerland  
Rue des Grillons 1  
CH-2800 Delémont  
Switzerland  
e-mail: [m.cock@cabi.org](mailto:m.cock@cabi.org)