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A new subspecies of *Cymothoe fumana* (Westwood, 1850) from Western Nigeria (Lepidoptera: Nymphalidae: Limenitidinae)

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Abstract: A new subspecies of *Cymothoe fumana* is described from Western Nigeria. It differs from the other three recognized subspecies significantly in the colour patterns of the females, but the males are nearly indistinguishable. The new taxon is yet another example of endemism among western Nigeria butterflies.

Key words: Lepidoptera, Nymphalidae, Limenitidinae, *Cymothoe*, endemism, Guineo-Congolian forest zone, West Africa.

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INTRODUCTION

Cymothoe Hübner, 1819 is among the best known Afrotropical butterfly genera. The genus is widely distributed in the Guineo-Congolian forest zone, and also in coastal forests and mountainous areas in East and Southern Africa. *Cymothoe fumana* (Westwood, 1850) is a well-known and easily recognisable rainforest species. Its range stretches from Sierra Leone in West Africa to eastern DRC and the Congo in the south. Currently three subspecies of *C. fumana* are recognised: *C. fumana fumana* (Westwood, 1850), distributed in forests west of the Dahomey Gap (from Ghana to Guinea), *C. fumana balluca* Fox & Howarth, 1968, whose range extends from Eastern Nigeria (Cross River Loop) and Western Cameroon throughout the Congo Basin, and *C. fumana villiersi* Fox, 1968, known only from the type locality, Mount Chaillu in the Congo. The validity of the latter taxon is doubted by Larsen (2005).

The first author has collected extensively in south-western Nigeria's remaining forest areas. His material is deposited in the Lepidoptera Collection of the Nature Education Centre (formerly Zoological Museum) of the Jagiellonian University in Kraków (Poland). This is also where the collection of the late Prof. Janusz Wojtusiak, who also collected Lepidoptera throughout southern Nigeria (1982-1986), is deposited. When curating the Limenitidinae material of these two collections, the first author discovered significant differences between the females of *C. fumana* occurring in Western Nigeria and the rest of Africa. Since further studies proved the differences are constant for all known females, and their occurrence could be biogeographically defined, the authors decided to describe the Western Nigerian populations as a new sub-species.

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MATERIALS AND METHODS

Morphological studies

Male and female genitalia were removed from abdomens and soaked in 10% KOH solution for 5-10 minutes. Subsequently, abdomens were preliminarily cleaned of soft tissue in water in order to expose the genitalia. Female abdomens were stained with chlorazole black in order to identify the soft parts of the genitalia. Dissected genitalia were cleaned using 90% and 95% ethanol solutions. A Nikon digital camera DS-Fi1 and an Olympus SZX9 stereomicroscope were used for imaging the dissections, which were then processed in Combine ZP and Corel PHOTO-PAINT X3 programs to enhance focus and improve quality. Genital dissections were retained in glycerol vials pinned under the corresponding specimens. Male genital terminology largely follows Klots (1956) and Razowski (1996).

Abbreviations

ABRI: African Butterfly Research Institute, Nairobi, Kenya
CEP-MZUJ: Nature Education Centre (formerly Zoological Museum), Jagiellonian University, Kraków, Poland
ANRHT: ex Sáfián Sz. research collection, African Natural History Research Trust, Leominster, UK

DESCRIPTION OF NEW SUBSPECIES

Cymothoe fumana royi Pyrcz & Sáfián **ssp. nov.** (Figs 1A, 1D; 3A, 3D; 2B, 2E; 4B, 4E)
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Holotype ♀: Ajebandele, Ondo State, Nigeria, 6°43'55.00"N, 4°21'30.00"E, 50m; 02.i.2000; T. Pyrcz leg.; Prep. genit. 442 17.08.2016/J. Lorenc-Brudecka; CEP-MZUJ.
Paratypes: 1♀: Ajebandele, Ondo State, Nigeria; 02.i.2000; T. Pyrcz leg.; DNA voucher UJ009. 1♀: Ajebandele, Ondo State, Nigeria; 02.i.2000; T. Pyrcz, DNA voucher UJ010. 1♀: Ajebandele, Ondo State, Nigeria; 02.i.2000; T. Pyrcz leg.; ABRI. 1♂: Ajebandele, Ondo State, Nigeria; 02.i.2000; T. Pyrcz leg., Prep. genit. 439 17.08.2016/J.Lorenc-Brudecka. 5♂: Ajebandele, Ondo State, Nigeria; 21.xi.1999; T. Pyrcz leg. 3♂: Ajebandele, Ondo State, Nigeria; 12.xii.1999; T. Pyrcz leg. 1♂: Ajebandele, Ondo State, Nigeria; 02.i.2000, T. Pyrcz leg. 1♂: Ajebandele, Ondo State, Nigeria; 29.viii.1999; T. Pyrcz leg, all CEP-MZUJ. 1♂: Ajebandele, Ondo State, Nigeria; 21.xi.1999, T. Pyrcz leg., ABRI.

Comparative material*:*
Cymothoe fumana fumana (Westwood, 1850): 1♂: Kakum National Park 13, Ghana; 15.v.2011. ABRI coll. Gen.prep.: 440 17.08.2016/J. Lorenc-Brudecka. 1♀: Kakum National Park 13, Ghana; 15.v.2011; ABRI prep. genit. 443 17.08.2016/J. Lorenc-Brudecka. 1♂: Agboville, Ivory Coast; iv.1970; Auberger leg. (ABRI).
Cymothoe fumana balluca Fox & Howarth, 1968: 2♂♂, 1♀: Awsamba, Oban Hills, Cross River State, Nigeria; 17.xi.1985, J. Wojtusiak leg. 6♂, 1♀: Ebogo near Mbalmayo, Central Region, Cameroon; i-iv.2013; A. Awomou leg., CEP-MZUJ, 1♂: 10045 FipCam concession area, Kagnol, East Region, Cameroon, 02-06.v.2015; Sáfián, Sz. & Simonics, G. leg.; Prep. genit. 438 17.08.2016/J.Lorenc-Brudecka. 6♂, 1♀ 10045 FipCam concession area, Kagnol, East Region, Cameroon; 02-06.v.2015, Sáfián, Sz. & Simonics, G., leg.; Prep. genit. 441 17.08.2016/J.Lorenc-Brudecka. 3♀: 10045 FipCam concession area, Kagnol, East Region, Cameroon; 02-06.v.2015, Sáfián, Sz. & Simonics, G. leg. ANHRT.

The original descriptions of *C. fumana balluca* and *C. fumana villiersi* were consulted (Fox, 1968), as well, as descriptions of other high quality illustrations of the species in d'Abrera (2004), Berger (1981) and Larsen (2005). Although the male holotype and female allotype of *C. fumana villiersi* fit in the range of individual variation observed in the species, the lack of availability of a series of specimens, and the insufficient quality of the original illustrations, did not allow the authors to take a formal decision on its taxonomic status. *C. fumana villiersi* is therefore treated here as a valid subspecies until further material is available for comparative study.

Descriptions:

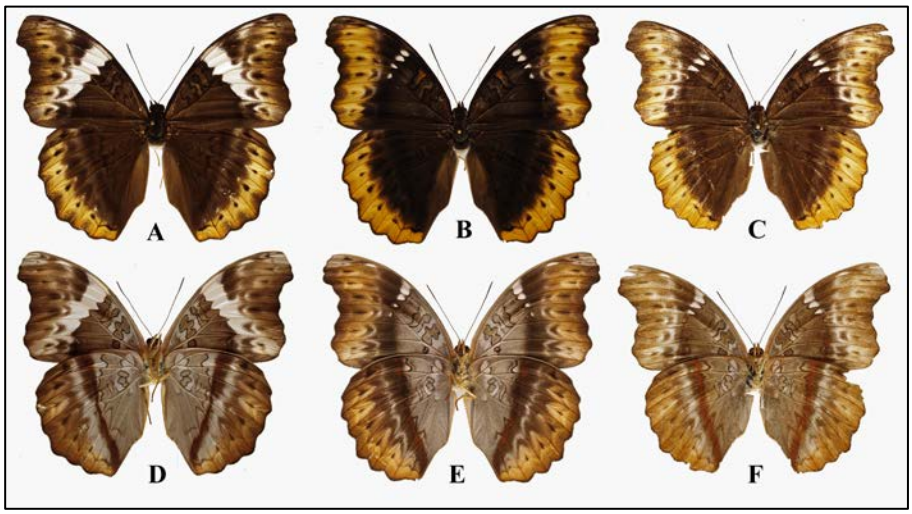
Holotype ♀ (Figs 1A, 1D):
Wingspan: 84 mm. Forewing length: 46.5 mm. Head, thorax and abdomen: do not differ from the nominotypical subspecies. Upperside ground colour dark brown with usual amoeboid and zigzagging *Cymothoe* pattern. Margin broad ochreous on hindwing, with a row of brown marginal spots, dusted with brown in spaces, more diffuse on forewing, restricted to rings around brown sub-marginal spots. Spots not connected by fine zigzagging line beyond vein 3. Forewing with broad, white continuous sub-apical band between costa and vein 2, also row of black chevrons edged with white in spaces 1b, 2, 3, 4. Underside paler, *Cymothoe* pattern easily visible; on forewing prominent white sub-apical band also present; hindwing white-brown, mottled with reddish central line, followed by white band. Margins brown, with ochreous-yellow areas.
Genitalia (Fig. 2B): Papillae prominent, covered with delicate and rather dense hair, with a protuberance in the middle; lamella antevaginalis strongly sclerotized, funnel-like, ending in a narrow tube, slightly longer than in other subspecies; ductus bursae long, weakly sclerotized, and gradually extending into an oval bursa, devoid of signa; apophyses posteriorly long and thin.

Paratype ♂♂ (Figs 3A, 3D):
Wingspan: 66 mm. Forewing length: 37 mm. Most of forewing (costal-apical-marginal area) light ochreous-yellow with prominent dark brown patch in spaces 1b, 1b and 2, extending also into basal half of discoidal cell. Marginal line prominent, dark brown, small dark spots present in spaces 1b, 2, 3, 4, 6; vein 8 brown before reaching apex. Hindwing largely dark brown with broad light ochreous-yellow margin and row of sub-marginal chevrons, connected with fine, diffuse brown, zigzagging line. Whitish, oval androconia present along costa. Underside light brown, ochreous-yellow, mottled, with rather straight brown cross-lines, some whitish-greyish scaling also present in sub-basal area in both wings, including three triangles on cross-line on forewing and broadening triangular band on cross-line from discoidal cell to inner margin. Body and long antennae brown; legs ochreous.

Genitalia (Figs 4B, 4E): Tegumen rectangular; uncus bifurcate, upper and lower processes wrench-like; vinculum rather weakly sclerotized, narrow and wavy; saccus triangular, short; valvae moderately haired, long (longer than the actual height of the genitalia) and very elongate, tapering down to narrow, but rather blunt tip, also with thumb-like inner lamella or projection; aedeagus lanceolate with acute apex, bent slightly downwards.

Diagnosis

The female of the new subspecies differs from all other recognised subspecies of *C. fumana* in the prominent white subapical patch, which forms three or four small, oval or triangular spots in *C. fumana fumana* and *C. fumana balluca*, but never a fused, continuous band. The band or white spotting is completely missing in the female allotype of *C. fumana villiersi*.



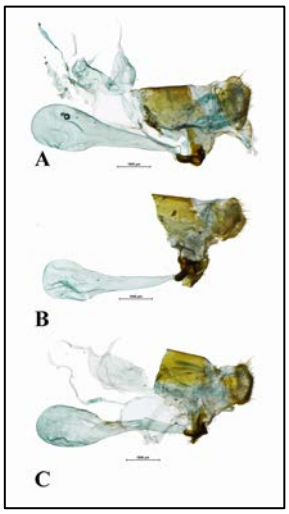
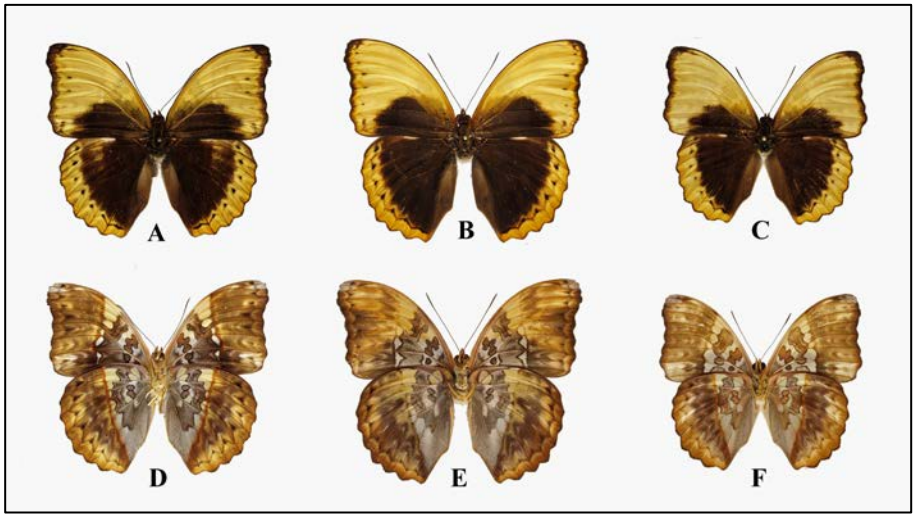


Figure 1 (left) **–** *C. fumana* females. *C. fumana royi* (holotype), A: upperside, D: underside; *C. fumana balluca* B: upperside, E: underside; *C. fumana fumana* C: upperside, F: underside.

Figure 2 (right) **–** Female genitalia. A: *C. fumana balluca* (Ebogo, Cameroon), prep. genit. 441 17.08.2016/J.Lorenc, CEP-MZUJ; B: *C. fumana royi* (holotype); C: *C. fumana fumana* (Ghana), prep.genit. 443 17.08.2016/J.Lorenc, CEP-MZUJ.



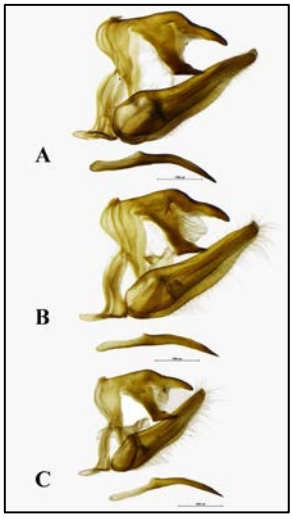


Figure 3 (left) – Males: *C. fumana royi* (paratype) A. upperside, D. underside; *C. fumana balluca* B. upperside, E. underside; *C. fumana fumana* C. upperside, F. underside.

Figure 4 (right) – Male genitalia (lateral view, aedeagus extracted in lateral view): A, D. *C. fumana balluca* (Ebogo, Cameroon). prep. genit. 438 17.08.2016/J.Lorenc, CEP-MZUJ; B, E. *C. fumana royi* (paratype). prep. genit. 439 17.08.2016/J.Lorenc, CEP-MZUJ; C, F. *C. fumana fumana* (Ghana) prep. genit. 440 17.08.2016/J.Lorenc, CEP-MZUJ.

There is only one female in the material of *C. fumana* in the ABRI collection, whose white spots are more prominent (Agboville, Ivory Coast ex. coll. Michel Beaurain), but they are still separated by brown bands along the veins. The female of *C. fumana royi* can be consistently separated from other similar *Cymothoe* females with regular or occasional white apical band: *C. hesiodotus*, *C. heliada*, *C. colmanti* and *C. hypatha* (ssp. *hypatha*), which have broad deep-orange margin instead of ochreous-orange as in *C. fumana royi*. These species also lack the orange margin of the forewing, which is typical of all subspecies of *C. fumana*. The common female form of *C. haynae* has a significantly narrower white sub-apical band on the forewing and the ochreous colour in the margins is also reduced, and does not form a marginal band. The male can be distinguished from *C. fumana balluca* by the paler yellow upperside, and from both *C. fumana balluca* and the nominotypical subspecies by the larger whitish patches on the FWV postdiscal area. Neither male nor female genitalia seem to present diagnostic features for the subspecies.

Males of the subspecies of *C. fumana* show a certain level of variation in the extent of dark brown area on the upper side of both wings, the number and prominence of marginal spotting, and also in the presence and prominence of chevrons and sub-marginal zigzagging line.

Etymology: The new taxon is dedicated to Dr. Roger Roy, former professor of entomology at the University of Dakar and the Institut Fondamental d'Afrique Noire, Senegal. Professor Roy wrote various papers about West African natural history, including the fauna of the

Nimba Mountains (Guinea-Ivory Coast-Liberia), a mountain range famous for its unique wildlife. He also introduced the then-young first author to Lepidoptera collecting in Africa.

DISCUSSION

In the last few decades a number of butterfly taxa have been discovered in the area, which is best defined as the Western Nigeria sub-region (between the Dahomey Gap and delta of the Niger River. Some of these taxa were found to be distinct enough to be described as species, whereas others have received sub-specific status (Larsen, 2005). The information on taxa restricted to the Western Nigerian sub-region was recently summarized in Sáfián *et al.* (2016). *C. fumana royi* is another taxon recognised to be restricted to this rather narrow forest area, but the minor differences between males and also in the genitalia of both sexes in the neighbouring populations, justified only sub-specific division within *C. fumana*. Due to extensive clearing of natural forest, the new subspecies was found only in a small area, but it is very probable that systematic butterfly surveys would eventually find it in other relict forests in Western Nigeria. Interestingly, *C. fumana* does not seem to occur in the relic forests of neighbouring Benin despite extensive sampling in that country (Coache et al., 2017). Other than the type series, the only other specimens found were deposited in the Agricultural Research Institute, Zaria, north of Kaduna, Northern Nigeria, but these specimens do not carry labels (and therefore it was not appropriate to include them in the type series). It is also very unlikely that *C. fumana royi* occurs so far into the Guinea savannah zone, despite the occurrence of many forest species in the forested gullies of the Jos Plateau and the riverine forests near Kaduna (Larsen, 2005).

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The authors are grateful to Michel Beaurain for useful discussions about variability of *C. fumana* females, to Steve Collins (ABRI) who allowed examination of further specimens of *C. fumana fumana*. Jadwiga Lorenc-Brudecka (CEP-MZUJ) kindly helped with the dissection and photography of the genitalia, and Diewuko Knoop (Tel-Aviv) provided the photographs of several Nigerian specimens of *C. fumana*.

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