ANNALES MUSEI HISTORICO-NATURALIS HUNGARICI
Volume 116 Budapest, 2024 pp. 131–165

HU-ISSN 0521-4726 (print) ISSN 2786-1368 (online)
arrived: 2024. 01. 05. published: 2024. 06. 03.

Descriptions of four new species of Capys from East and West Africa with notes on adult morphology and biogeography (Lepidoptera: Lycaenidae: Theclinae)

Szabolcs Sáfián[1,2] *, Steve C. Collins[1], Hitoshi Takano[3], Zdenek Faltynek Fric[4],
Balázs Tóth[2], Gergely Katona[2], Gábor Piszter[5], Zsolt Bálint[2,5]

[1] *African Butterfly Research Institute, P.O. Box 14308, 0800 Nairobi, Kenya.*
E-mails: collinsabri@gmail.com; szsafian@gmail.com
[2] *Hungarian Natural History Museum, Department of Zoology,*
H-1088 Budapest, Baross utca 13, Hungary.
E-mails: katona.gergely@nhmus.hu; toth.balazs@nhmus.hu; balint.zsolt@nhmus.hu
[3] *African Natural History Research Trust, Street Court, Kingsland, Leominster,*
Herefordshire, HR6 9QA, United Kingdom. E-mail: hitoshi.takano@anhrt.org.uk
[4] *Biolog Centre CAS, CZ– 37005 Ceske Budejovice, Branisovska 31, Czech Republic.*
E-mail: fric@entu.cas.cz
[5] *HUN-REN Centre for Energy Research, Institute of Technical Physics and Materials Science,*
H-1121 Budapest, Konkoly Thege út 29–33, Hungary.
E-mail: piszter.gabor@ek.hun-ren.hu; balint.zsolt@ek.hun-ren.hu

Abstract – Four new species of the hairstreak butterfly genus *Capys* Hewitson, [1865] (Lepidoptera: Lycaenidae: Theclinae: Deudorigini) are described: *C. arba* Sáfián et Fric, sp. n. (type locality: Ethiopia, Dorze Lodge), *C. moroto* Sáfián et Collins, sp. n. (type locality: Uganda, Mount Moroto), *C. robertsi* Collins et Sáfián, sp. n. (type locality: Kenya, Mount Kenya, moorland above Marania Bredt), and *C. smithi* Takano et Sáfián, sp. n. (type locality: Ivory Coast, Comoé National Park). Morphological features such as male genitalia, dorsal hindwing surface, androconia and labial palps, previously used in the separation of *Capys* species, are reviewed. Biogeography of the newly described species is also discussed using evidence from molecular analysis. With 74 figures.

Key words – androconia, *Capys arba* sp. n., *Capys moroto* sp. n., *Capys robertsi* sp. n., *Capys smithi* sp. n., COI barcodes, endophagy, labial palps, male genitalia, *Protea*, scent patch

---

* corresponding author.

DOI: *https://doi.org/10.53019/AnnlsMusHistNatHung.2024.116.131*
ZOOBANK: *http://zoobank.org/urn:lsid:zoobank.org:pub:57730EA3-07BD-44EF-85B8-F1E8E1F3CDFE*

INTRODUCTION

The subfamily Theclinae (Lepidoptera: Lycaenidae), commonly known as the Hairstreaks, was divided into 18 tribes by John Nevill Eliot (1912–2003) in his tentative Lycaenidae classification (Eliot 1973), indicating the triplet of Deudorigini (exclusively Old World), Eumaeini (Holarctic and Neotropical) and Tomarini (exclusively Palaearctic) as being monophyletic (Eliot 1973: fig. 1), an arrangement that was subsequently confirmed by molecular analyses (Robbins *et al.* 2022). This triplet of hairstreaks can be characterised by the great variety of alar androconia, by the lack of juxta in the male genitalia and by their peculiar life history with the larvae of many genera known to be endophagous living in the inflorescence or in the fruit of their hostplants (Murray 1935, Larsen 2005, Libert 2005, Robbins 2010, Benyamini 2023). The exclusively African deudorigine genus *Capys* Hewitson, [1865] is a typical representative of this group: males have a dorsal hindwing surface scent pad in the postbasal region below the costa, the male genitalia lack the juxta and the larvae live exclusively in the large flower buds of *Protea* (Proteaceae), a characteristic angiosperm genus of sub-Saharan Africa, especially rich in the Cape Floral Region (Rourke 1998). Since the revision of the genus by Henning & Henning (1988), that covered all possible details from minor morphological characters to the distribution of the larval foodplants across sub-Saharan Africa of the then known taxa and those described in the paper, it was considered that not much information could be added by subsequent authors.

Nevertheless, in less than two decades since the paper of Henning & Henning (1988), researchers of the African Butterfly Research Institute continued to look for the presence of *Protea* stands in East Africa and wherever the signs of *Capys* larvae were present in *Protea*, the adults were bred, resulting in another species, *Capys usambarae* Congdon et Collins, 1998 from Tanzania. Moreover, two further species, *C. stuarti* Collins et Larsen, 2000 and *C. vorgasi* Larsen et Collins, 2003 were described from West Africa, where the presence of *Protea* had already been indicated by Henning & Henning (1988). Besides the taxa listed in Henning & Henning (1988), Congdon & Collins (1998), Collins & Larsen (2000) and Larsen & Collins (2003), additional taxa were discovered in Kenya and Uganda which could not be assigned to any existing species. More recently, a single male *Capys* specimen was collected by the African Natural History Research Trust in a lowland savannah locality in Ivory Coast which was found to be conspecific with three specimens collected near Mole National Park, another lowland savannah locality in northern Ghana. The ground colour of these males are visibly different from that of *C. vorgasi*, a species that occurs in the upland savannah habitats of the Togo Mountains (Volta Region, Ghana) (Larsen 2005). These specimens represent a yet undescribed species, the first *Capys* taxon that genuinely inhabits lowland biotopes. Despite the presence of at least two *Protea* in the country (iNaturalist)(¹), no species of *Capys* were previously recognised from Ethiopia. However, a few *Capys* specimens were collected near Arba Minch, which belong to another undescribed species.

This paper aims to report these new findings with the goals of (1) formally describing the new species based on both phenotypic and male genitalia traits, as well as geographical patterns of distribution, (2) documenting and figuring the type material and genitalia structures, and (3) briefly discussing the results in light of HENNING & HENNING (1988), especially the use of the characteristics of androconia, labial palps and male genitalia for taxonomic discrimination.

MATERIALS AND METHODS

Acronyms and abbreviations – ABRI = African Butterfly Research Institute (Nairobi, Kenya); ANHRT = African Natural History Research Trust (Leominster, United Kingdom); APLORI = A. P. Leventis Ornithological Research Institute (Jos, Nigeria); BOLD = Barcode Of Life Data System(²); CEPUJ = Nature Education Centre of the Jagiellonian University (Kraków, Poland); CER = Institute of Technical Physics and Materials Science, Centre for Energy Research (Budapest, Hungary); HNHM = Hungarian Natural History Museum (Budapest, Hungary); gen. prep. = genitalia preparation; ICZN = International Commission on Zoological Nomenclature; IECA = Biology Centre, Czech Academy of Sciences, Institute of Entomology (České Budějovice, Czechia); LG = Gyula László (for ANHRT dissections); n = number of sample; reg. = registration code (for ABRI genitalia dissections); SAFI = Szabolcs Sáfián (for genitalia samples); TB = Balázs Tóth (for HNHM dissection numbers); ZF = Zdenek F. Fric.

Specimens – Beside the 104♂♂, 36♀♀ (= 140) specimens serving as type material of species described in the present paper, a further 89♂♂, 73♀♀ (= 162) *Capys* specimens have been examined. Authors of binomens and their years of descriptions of each species are given below in the checklist. Holotype data are given verbatim according to the corresponding label.

Capys alpheus (n = 3) – SOUTH AFRICA: Western Cape, Sommerset West env., Hottentot Mts., 34°02'25.0"S 19°37'35.3"E, 7. XII. 2014, Selb H. & Faltýnek Fric Z. leg. (IECA: ZF-LY-002725, ZF-LY-002726, ZF-LY-002727) (2♂♂, 1♀).

Capys disjunctus (n = 1) – SOUTH AFRICA: Gauteng, Pretoria, hills above Walter Sisulu Botanical Gardens, 26°4'48.32"S, 27°49'45.05"E, 1720 m, 27. XI. 2019, Sáfián Sz., & Dobson, J. leg. (CEPUJ: DNA 3028, AZ 705) (♂).

Capys juliae (n = 65) – KENYA: Cherangani Hills (most specimens bred), various dates between VIII.1977 and V.1992, leg. ABRI (ABRI paratypes: 3♂♂, 1♀; 8♂♂, 23♀♀); Eldoret, various dates ABRI leg. (ABRI: 17♂♂, 13♀♀).

---

¹ https://shorturl.at/rvSX7

² https://www.boldsystems.org

Capys meruensis (n = 23) – KENYA: Meru 7000 ft. I.1977. Bred from *Protea*, Collins S. C. leg. (ABRI paratypes: 3♂♂, 1♀); Meru, Mount Kenya, 5000 ft, XII. 1989. Collins S. C. leg.; gen. prep.: SAFI00406 (ABRI: 1♂); Meru, Mount Kenya 5000 ft, various dates between VII. 1977 and III. 1991 (bred), Collins S. C. leg. (ABRI: 11♂♂); Meru, Mount Kenya, 5000 ft, various dates between II. 1991, Collins S. C. leg. (ABRI: 7 ♀♀).

Capys sp. (near *moroto* sp. n.) (n = 11) – KENYA: Mount Sekerr, 8000 ft, I. 1992, Collins S. C. leg. (ABRI: 3♂♂, 1♀); Mount Sekerr, Loima Hills, no date, ABRI leg. (ABRI: 3♂♂, 4♀♀).

Capys stuarti (n = 11) – NIGERIA: Plateau State, Jos Amurum, no date, ABRI leg. (ABRI: 1♂, 1♀); Plateau State, Jos Amurum (APLORI) 17. X. 2007, hatched from pupa, Brattström O. leg. (ABRI: 2♂♂, 7♀♀).

Capys vorgasi (n = 46) – Holotype, GHANA: Likpe Mate, Volta Region, VII. 2000, Vorgas R. leg.; gen. prep.: SAFI00403 (ABRI holotype: ♂, paratypes: 24♂♂, 2♀♀); Likpe Mate, Volta Region various dates between 2000 and 2013, Vorgas R. leg. (ABRI: 7♂♂, 11♀♀); Oti Region, Kyabobo National Park, Laboum River Valley, 8°19'55.09"N, 0°34'54.20"E, 300–550 m, 11–20. XII. .2022, Sáfián, Sz. & Győri, G. leg. (HNHM: ♂); Likpe, 15. VIII. 2022, Lwandi P. leg. (IECA, 1♂, 1♀: HK-001, HK-002).

Labial palps – Labial palps were taken from the specimens listed below. The organ is stored with the corresponding specimen in micro vial and kept with the voucher deposited in ABRI, ANHRT and CEPUJ.

Capys arba sp. n.: ZF-LY-002867 (holotype); *C. juliae*: SAFI00401; *C. moroto* sp. n.: SAFI00400 (holotype), SAFI00412 (paratype); *C. robertsi* sp. n.: PAL 001, SAFI00405 (paratype); *C. smithi* sp. n.: ANHRTUK00194563 (holotype), SAFI00402; *C.* sp. near *moroto* ("Sekerr"): SAFI00410; *Capys vorgasi*: SAFI00411.

Genitalia – Abdomens were taken from the specimens listed below. The dissected genitalia are stored with the corresponding specimen in micro vials, or mounted on microscope slide and kept in the institute where the voucher is deposited (see references throughout this paper).

Capys arba sp. n.: ZF-LY-002867 (holotype); *Capys juliae*: SAFI00401, SAFI00411, TB2314m, TB2317m; *Capys meruensis*: SAFI00406, TB2306m; *Capys moroto* sp. n.: SAFI00412, TB2307m (paratype); *Capys robertsi* sp. n.: SAFI00404, SAFI00405, TB2313m (holotype), TB2316m (paratype); *Capys smithi* sp. n.: LG4162 (holotype); *Capys stuarti*: SAFI00408, SAFI00409, TB2308m, TB2305m; *Capys vorgasi*: SAFI00403: TB2315m (holotype), TB2331m.

Identification, checklist and distribution – Identifications and distributional interpretations were based on HENNING & HENNING (1988) and the comprehensive iconography of D'ABRERA (2009), where most species were illustrated in high quality colour photographs, including many types. WILLIAMS (2023) compiled all references and composed a list of taxa using an updated classification system and nomenclature, followed also in this paper, updating the known distribution of each taxon as given in the presented checklist below. Our taxonomic decisions are compatible with the approach of Henning & Henning (1988), as well as Collins & Larsen (2000, 2003), who recognised each taxon geographically separate and isolated from its relatives as distinct species rather than subspecies. This standpoint also corresponds with the biological species concept as discussed by de Queiroz (2007), who highlighted that in many cases geography carries crucial information in species delimitation, which should be more often taken into consideration. Since no phylogeny has been previously established for all members of the genus, the species are listed in alphabetical order with indications to their distribution based on the papers of Henning & Henning (1988), Larsen (1991), Congdon & Collins (1998), Collins & Larsen (2000), Heath et al. (2002), Larsen (2005), d'Abrera (2009), Congdon et al. (2010), Armstrong (2020), Williams (2023), Sáfián (2023).

Methods of morphological investigations – Comparative material and types kept as pinned, set, dried and labelled specimens in curated taxonomic collections of ABRI, ANHRT, CEPUJ, and HNHM. Labial palps were investigated using optical stereo-microscopes in HNHM using an OLYMPUS SZX12. Optical imaging of the scent patch was carried out in CER using a Nikon Eclipse LV150N (Shinagawa, Tokyo, Japan) microscope in reflected light. For better visibility, we used focus stacking to compensate for the narrow depth of field of the high-resolution microscope objectives. Genitalia dissections were performed applying the standard procedures (Winter 2000). The process of digital images of photographed specimens, labial palps and genitalia dissections follows those described in Sáfián (2020) and in Bálint *et al.* (2022).

COI public sequences – Publicly accessible COI sequences were downloaded from BOLD as Electropherogram Trace Files:

Capys disjunctus: ♂, Democratic Republic of Congo, Katanga, BOLD sample ID: BC-TB7635 (specimen depository: Research Collection of Thierry Bouyer)(3).

Capys disjunctus: ♀, Democratic Republic of Congo, Katanga, BOLD sample ID: BC-TB7650 (specimen depository: Research Collection of Thierry Bouyer)(4).

DNA extraction and COI sequencing – For further clarification of the taxonomic statuses and relationships of West African *Capys* taxa, specimens of *C. vorgasi* from its type locality and *C. stuarti* from near the type locality were selected for DNA extraction and COI sequencing. Geographically distant species, such as the South African *C. alpheus*, *C. disjunctus* and the Ethiopian *C. arba* sp. n., were selected as ingroup species. An African member of the tribe Deudorigini, *Deudorix lorisona* (Hewitson, [1863)] and a more distant European

---

[3] http://boldsystems.org/index.php/Public_RecordView?processid=TBBUT482-11&fbclid=IwAR38odGUqnQIJPNbMoswBxh4Aaqfp1AWEvrr2V2e6iMDycAGPLYg6ukhEA

[4] http://boldsystems.org/index.php/Public_RecordView?processid=TBBUT497-11&fbclid=IwAR0l03qceS1R6Qejgxvat8v2THlGEjU0YBhOZ7BUtmzy6rHQJgGh4bvszoI

member of the subfamily Theclinae, *Tomares nogelii* (Herrich-Schäffer, 1851) were selected as outgroup species for maximum likelihood tree reconstruction.

DNA was extracted from two legs or the anterior part of the abdomen using the Geneaid Blood and Tissue extraction kit. We sequenced the mitochondrial gene Cytochrome c oxidase subunit I (COI), often referred to as "barcode region", regularly used for species identification, and thus comparative samples are also often publicly available. We used two forward-reverse primer pairs: LCO/HCO and in the case of more degraded material, Ron/HCO (Wahlberg & Wheat 2008). The universal tails T7 and T3 Promoter were attached to all primers. For the PCR, we followed the protocols of Monteiro & Pierce (2001), Wahlberg & Wheat (2008) and Vila *et al.* (2011). The PCR products were sequenced by Macrogen Inc. (Korea) using an ABI 3730XL DNA analyser. We checked and aligned the sequences with Geneious v.7.1.9. (Kearse *et al.* 2012) and submitted them to GenBank([5]) (Accession codes PP096867-PP096886). The COI sequence of the *C. smithi* sp. n. holotype was obtained using Single Molecule Real-Time sequencing through the Sequel (PacBio) pipeline at the Canadian Centre for DNA Barcoding, Biodiversity Institute of Ontario, University of Guelph (Hebert *et al.* 2018).

COI maximum likelihood tree reconstruction – We constructed a Maximum Likelihood tree using IQ-Tree 1.6.5 (Nguyen *et al.* 2015) with 10,000 bootstraps. This method calculates the tree with the best likelihood, and prior to the calculation it tests for an appropriate substitution model (in this case TIM2+F+I, -LnL = 1506.4, BIC = 3300.3), selected by Bayesian Information Criterion (BIC) (cf. Kalyaanamoorthy *et al.* 2017). For compatibility with other barcoding studies, we measured the paired barcode distance using K2P substitution model in MEGA11 (Tamura *et al.* 2021).

Maps – The distribution maps were edited in Adobe Photoshop CS5 with the aid of Google Earth Pro GIS.

RESULTS

Classification

Superfamily PAPILIONOIDEA Latreille, 1802
Family LYCAENIDAE Leach, 1815
Subfamily THECLINAE Swainson, 1831
Tribe Deudorigini Doherty, 1886
Genus *Capys* Hewitson, [1865]
Type species: *Papilio alpheus* Cramer, 1775; by monotypy

---

[5] http://www.ncbi.nlm.nih.gov/

Generic diagnosis – Ocelli absent, chaetosemata present, no tympanal organ, hindwing without frenulum (Papilionoidea); tibial spurs 0-2-2, foretibia without epiphysis, tibiae unspined, tarsal claws not bifid; labial palpi with average length and upcurved, functional and normal in length (Lycaenidae); antennal club cylindrical, hind wing with tornal lobe, male genitalia without juxta, eyes hairy (Theclinae); forewing with 11 or 12 veins, male fore tarsus terminus with tapered, down curved point (Deudorigini); no structural colour, hindwing with scent patch at vein 7 erection, hostplant exclusively *Protea* (Eliot 1973; Heppner 1998).

Checklist and distribution

Capys alpheus (Cramer, [1777]) – ssp. *alpheus* (Cramer, [1777]): South Africa, Northern Cape Province via Western Cape to southern part of Eastern Cape Province; ssp. *extentus* Quickelberge, 1979: South Africa from northern Eastern Cape Province via KwaZulu-Natal, Free State and Mpumalanga Provinces to Limpopo Province. Also in Eswatini.

Capys arba Sáfián et Fric, sp. n. – Ethiopia, south on the escarpment along the Rift.

Capys bamendanus Schultze, 1909 – Cameroon, Bamenda Highlands. Potentially also on the Adamawa Plateau and in the adjacent eastern Nigerian high-altitude areas.

Capys bamptoni Henning et Henning, 1988 – South Sudan, Imatong and Didinga Mountains.

Capys brunneus Aurivillius, 1916 – ssp. *brunneus* Aurivillius, 1916: Tanzania, southern mountainous areas, Malawi, Mount Mulanje; ssp. *heathi* Henning et Henning, 1988: Zambia, North-western Province.

Capys calpurnia Henning et Henning, 1988 – Kenya, Mount Nyiro.

Capys catharus Riley, 1932 – Tanzania.

Capys collinsi Henning et Henning, 1988 – Kenya, Ol'Doniyo Sabuk Mountain.

Capys connexiva Butler, 1897 – ssp. *connexiva* Butler, 1897: Tanzania, Malawi, Zimbabwe, Zambia, Angola, possibly also Mozambique; ssp. *gardineri* Henning et Henning, 1988: Zambia, Mufulira.

Capys cupreus Henning et Henning, 1988 – Kenya, Mau Escarpment (Henning & Henning 1988).

Capys disjunctus Trimen, 1895 – Mozambique, Zimbabwe, South Africa, Eswatini.

Capys hermes Henning et Henning, 1988 – Kenya, Central Highlands.

Capys juliae Henning et Henning, 1988 – Kenya, Cherangani Hills and other isolated mountain areas in central-western Kenya.

Capys meruensis Henning et Henning, 1988 – Kenya, Meru, lower, north-eastern slopes of Mount Kenya.

Capys moroto Sáfián et Collins, sp. n. – Uganda, Mount Moroto. Possibly in other extinct volcanoes in the Karamoja Region.

Capys penningtoni Riley, 1932 – South Africa, KwaZulu Natal.

Capys rileyi Stoneham, 1938 – Kenya (west), Uganda (east).

Capys robertsi Collins et Sáfián, sp. n. – Kenya, Mount Kenya, high altitude moorland above the treeline.

Capys smithi Takano et Sáfián, sp. n. – Ghana, Ivory Coast, lowland savannah areas west of the Volta River system.

Capys stuarti Collins et Larsen, 2000 – Nigeria, Jos Plateau and possibly other higher altitude areas in north-central Nigeria.

Capys usambarae Congdon et Collins, 1998 – Tanzania, West Usambara.

Capys vorgasi Larsen et Collins, 2003 – Ghana, Togo Mountains (Likpe and Kyabobo), probably also in Togo, since the localities are situated right on the Ghana-Togo border with habitat and foodplant available also in Togo.

Species descriptions

Capys arba Sáfián et Fric, **sp. n.**

(Figs 24, 29, 42, 67)

Type material – Holotype ♂: ETHIOPIA: Dorze Lodge (2400 m), 11–30.I.2015. N 06 10 56, E 037 34 35, Vladimir Major leg.; unique code: ZF-LY-002867; deposited in CEPUJ (Fig. 24). Paratypes: ETHIOPIA: near Dorze (2401 m), 11–30.I.2015. N 6 10 838, E 37 34 793. Leg.: M. Ströhle. (9♂♂, 1♀); deposited in Ströhle's collection. GenBank Accession code PP096874 (Fig. 29).

Diagnosis – The external characters of all potentially similar *Capys* species had to be examined but in general appearance none of the taxa in the geographic proximity could be considered very similar to *C. arba* sp. n. In the males, the most similar species with its narrow dull red patch interrupting by the brown veins on both forewing and hindwing is *C. brunneus* (distributed in Western Tanzania, Malawi and as a distinct subspecies *C. b. heathi* in Zambia), whose males also share a concave outer forewing margin (Heath *et al.* 2002, Williams 2023). Moreover, the male *C. brunneus* lacks visible androconia in the subbasal area of hindwing dorsal surface and the hindwing ventral surface has a strong pattern (in both subspecies) compared to that of *C. arba* sp. n. Geographically, the nearest taxa are *C. bamptoni*, *C. calpurnia, C. juliae*, and *C. rileyi*, but none of them seem to be close to *C. arba* sp. n. as males of the first three species express more extensive orange-red colouration on the dorsal surface, extending into the basal area (setting them far apart from *C. arba* sp. n.), while the last species has smaller, but visibly much brighter orange-red patches, compared to any males in the type series of *C. arba* sp. n.. The ten known males of *C. arba* sp. n. vary in wingspan (see at description) and the width of the red patch of the forewing dorsal surface, but the red colouration does not penetrate the basal area. The extent of the red patch on the hindwing dorsal surface also varies, being almost diffuse in one of the paratype specimens.

Description – Male: Tip of labial palp narrow, second segment long with large fan-like scales, third segment 1/5× as long as second segment (Fig. 67). Forewing length: 13.5–17.0 mm. Wingspan: 27.5–34.0 mm (n = 10). Outer edge of forewing distinctly concave between veins 2 and 4, median area of dorsal forewing surface and outer half of hindwing with narrow patches; patches dull deep reddish orange, crossing brown veins moderately conspicuous on hindwing. Inner edge of forewing reddish patch with a strong, v-shaped incision along vein 2. Subbasal area of dorsal surface of hindwing with a conspicuous androconial patch at fork of veins 6 and 7 (width of patch = 2 mm). Ground colour of ventral surface dark graphite-grey with an orange shade identical to forewing. Bands of hindwing formed by dark pearly spots well-developed and complete; some spots overlayed by dull reddish scales. Hindwing margin with a row of dull reddish lunules in spaces 1b, 2, 3 and 4, rest of the submarginal area slightly darker than the rest of the wing (Fig. 24). Ground plan of genitalia similar to other *Capys* species with the dorsally bi-lobed and sparsely haired uncus, slender, in dorso-ventral view upcurved brachia, characterless tegumen, rudimental, basally fused lanceolate valvae, and with fine hairs on the terminal half. Aedeagus slightly bent, slightly longer than capsula, with finely down curved subzonal posterior end, suprazonal portion straight and somewhat shorter than subzonal part. Vesica with a single membranous cornutus (Fig. 42).

Female: Forewing length: 19.5 mm. Wingspan: 38 mm. General appearance similar to congeneric species. Entire dorsal surface light slivery grey, slightly darker in forewing basal and apical area. Marginal line dark grey with whitish fringes. Ventral surface also light silvery grey with well-defined and distinctly darker, pearly median bands, and with a cell-closing spot. Marginal lunules of hindwing diffuse, reddish on dorsal surface, dark grey with reddish scales on ventral surface (Fig. 29).

Etymology – The name “arba” refers to the Ethiopian city of Arba Minch (Forty Springs), which is near the type locality of *C. arba* sp. n.; noun in apposition.

Capys moroto Sáfián et Collins, **sp. n.**
(Figs 9–10, 14, 34–35, 53–55)

Type material – Holotype ♂: UGANDA, Mount Moroto, XI.2013. Leg.: Jean-Pierre Lecieux, ABRI; deposited in ABRI (Fig. 9). Paratypes: UGANDA: Mount Moroto, XI.2013. Leg.: Jean-Pierre Lecieux, ABRI (ABRI: 15♂♂ 2♀♀); UGANDA: Mount Moroto, IV–XII.2014. Jean-Pierre Lecieux, ABRI leg. (ABRI: 35♂♂ 19♀♀), UGANDA: Mount Moroto, I–XI.2015. Jean-Pierre Lecieux, ABRI leg. (ABRI: 11♂♂ 2♀♀) (Figs 10, 14).

Diagnosis – No other *Capys* species is known with a completely brown dorsal wingsurface in both sexes. *Capys moroto* sp. n. shares the almost straight outer margin of the forewing and the violet sheen on the dorsal surface only with the nearby distributed *C. juliae* (Figs 12–13: males, 15–16: females, 37: male genitalia, Figs 60–61: palps) but differs from it by the lack of coppery patch on the dorsal surface of males and by the much less conspicuous ochreous area on the forewing dorsal surface of females. The intensity of the violet iridescence varies, some male specimens appear with stronger coppery colour in the centre of the forewing. In males, the colour of the oval androconial spot also varies from lighter to darker brown, sometimes with stronger violet sheen.

Description – Male: Labial palp second segment short with ribbon-like scales, third segment short, with 1/6th second segment length (Figs 53–55). Forewing length: 14.5–18.0 mm. Wingspan: 28.5–33.0 mm (n = 70). Forewing outer margin almost straight, similar to that of *C. juliae*. Dorsal wingsurface completely greyish brown with an inconspicuous coppery area in the centre of the forewing and with a violet sheen, more visible on the hindwing. Hindwing marginal copper-coloured spots disjunct and inconspicuous, margin strongly scalloped. A conspicuous oval androconial spot present in the fork of veins 6 and 7 and in space 7, not reaching vein 8. Ventral surface silvery graphite-grey with a triangular pale ochre area between the inner margin and the discal cell on forewing, and with the usual "*Capys* bands", formed by the pearl-spots on the hindwing. Spots fused into two short bands, one starting from the costa and the other from the inner margin; not connected to each other. Marginal area between the apex and the tornus of the hindwing also darkened. Groundplan of genitalia similar to other *Capys* species with the dorsally bi-lobed and sparely haired uncus, slender upcurving brachia in lateral view, characterless tegumen and rudimental, basally fused lanceolate valvae, with fine hairs on their terminal half. Aedeagus almost straight, two times longer than the entire genitalia capsula, having a relatively wide zonal region in lateral view resulting subzonal and suprazonal portions somewhat narrowing at their middles, and slightly bent subzonal portion terminus. Vesica with a single membranous cornutus (Figs 34–35). Female: Forewing length: 16–18.5 mm. Wingspan: 31.5–36 mm (n = 22). As male, only forewing apex slightly less acute and its outer margin slightly convex (Fig. 14).

Etymology – The species is named after its type locality Mount Moroto in northeast Uganda; noun in apposition.

Remarks – Previously, only *Capys rileyi* has been known from Uganda (www.abdb-africa.org). *Capys moroto* sp. n. is very different in appearance and is morphologically closer to *C. juliae*, which species occur in western Kenya. Based on current knowledge, *C. moroto* sp. n. is restricted to the mountainous areas near Mount Moroto in northeast Uganda, but might be present locally in other mid-altitude mountains in the Karamoja Region of Uganda (Toror Hills, Mount Kadam). There is a *Capys* population in the mountainous areas near Sekerr in western Kenya, which in general appearance is even closer to *C. moroto* sp. n. Its taxonomical assessment needs further material to be examined as this population may represent an undescribed species (Figs 11, 36, 56–59 as "*Capys* n. *moroto*").

Capys robertsi Collins et Sáfián, **sp. n.**

(Figs 1–2, 5–6, 30–31, 62)

Type material – Holotype ♂: KENYA, Mount Kenya, 25.X.2003. Mount Kenya, 10 400 Ft, moorlands above Marania Bred. Collins/ABRI coll. Coordinates: 0°1'22.80"N, 37°24'12.64"E.; deposited in ABRI (Fig. 1). Paratypes: KENYA, Mount Kenya, 10 400 Ft, moorlands above Marania, Bred. Collins (ABRI: 19♂♂); KENYA, Mount Kenya, 10 400 Ft, moorlands above Marania 5.X.2003. Bred/ Ex-pupa Collins (ABRI: 12♀♀) (Figs 2, 5–6).

Diagnosis – In size, pattern and wingshape, both sexes of *C. robertsi* sp. n. are very similar to, but readily separable from *C. meruensis* (Figs 3–4: males, 7–8: females, 32–33: male genitalia). Males of *C. robertsi* sp. n. have darker and brighter coppery-red dorsal surface patches on the surface of both wings, which are orange-red with slight golden sheen in *C. meruensis*. The female of *C. robertsi* sp. n. has a prominent pale orange patch on the forewing dorsal surface. The forewing dorsal surface of *C. meruensis* females is completely dark grey with only inconspicuous ochre colouration between veins 2 and 5, from the discal cell towards the submarginal area of the outer margin, stronger only between veins 4 and 5, where a very inconspicuous, narrow ochre band is present. In the male genitalia *C. robertsi* sp. n. differs from *C. meruensis* by the distinctly narrower fused base of the valvae, while the central dip of the uncus is also less incised in *C. robertsi* sp. n. Subzonal aedeagus of *C. robertsi* sp. n. is slightly bent terminally in lateral view, while it is straight in *C. meruensis*. The male of *C. connexiva* is also similar in appearance, but its female is completely dark grey on the dorsal surface, with only reddish marginal spots on the hindwing (D'ABRERA 2009: 785, WILLIAMS 2022). Both sexes vary significantly in size, which most probably depends on food availability.

Description – Male: Labial palp second segment long with ribbon-like scales, third segment short, 1/7× as long as second segment (Fig. 62). Forewing length: 12–17.5 mm. Wingspan: 23.5–33.5 mm (n = 20). A large discal copper-red spot on both wings covering slightly more than half of the entire wing surface, leaving the base, the rather narrow costa, wider apex and outer margin on the forewing, as well as the broad costa and apex dark brown on the hindwing. Outer margin of the copper-red patch strongly lobed in spaces 1b, 2, 3 and 4. A plectrum-shaped androconial patch present in the subbasal area on the hindwing dorsal surface, in the fork of veins 6 and 7, reaching quite deeply into space 7, broadening from the base of the veins. Hindwing veins darkened inside the copper-red patch. Ventral surface silvery graphite-grey with a triangular pale ochre area between the inner margin and the discal cell on forewing, usual "*Capys* bands" also present on ventral surface, formed by the pearl-spots on the hindwing. Spots fused into two short bands, one starting from the costa and the other from the inner margin; being not connected to each other. Marginal area between the apex and the tornus of the hindwing also darkened (Figs 1–2). Groundplan of genitalia similar to other *Capys* species with the dorsally bi-lobed and sparely haired uncus, slender upcurving brachia, characterless tegumen and rudimental, basally fused lanceolate valvae, with fine hairs laterally on their terminal half. Aedeagus almost straight and two times longer than the entire genitalia capsula with slightly downcurved subzonal posterior end. Vesica with a single cornutus (Figs 30–31). Female (Figs 5–6): Forewing length: 11.5–20.5 mm. Wingspan: 24.5–39.5 mm (n = 12). Wing shape and pattern like those of male.

Etymology – The species is dedicated to Michael Roberts (Kenya), who first found the locality and collected the first specimens.

Remarks – The species *C. robertsi* sp. n. is superficially similar to the parapatric *C. meruensis*, but based on extensive breeding experiments by ABRI researchers, the former occurs only in the higher slopes of Mount Kenya from about 3000 m ASL and utilises *Protea gaguedi* J.F. Gmelin as a foodplant, whilst *C. meruensis* is apparently a lower altitude species found at 1500 m ASL where its foodplant is *P.* (*caffra*) *kilimandscharica* (Engl.) Chisumpa & Brummitt.

Capys smithi Takano et Sáfián, **sp. n.**

(Figs 17–19, 25–26, 38–39, 43–44, 63–64)

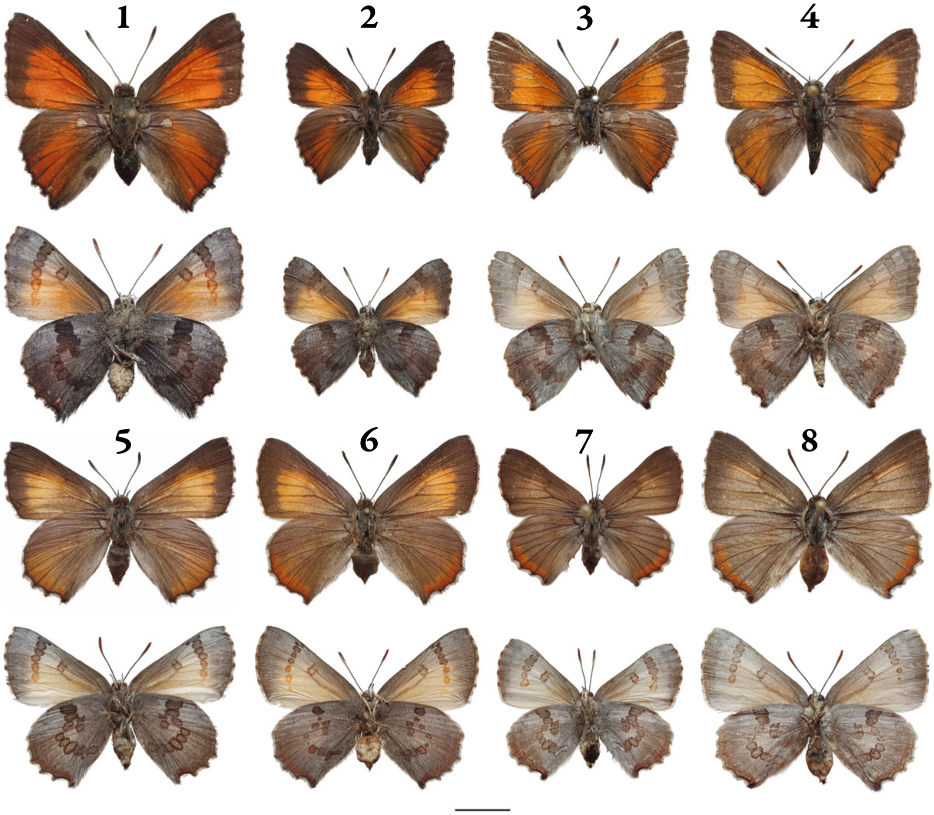
Type material – Holotype ♂: IVORY COAST: Comoe National Park, Comoe 2, N08 40 03, W03 47 03 27.VI–02.VII.15. Open forest. Leg. Aristophanous, M., Moretto, P., Ruzzier, E. ANHRT unique number: ANHRTUK00194563; deposited in ANHRT (Fig. 17). Paratypes: 2♂♂ GHANA, Mole; 1♀ GHANA, Mole, July 2012 R.V. ABRI leg.; all deposited in ABRI (Figs 18–19, 25–26).

Diagnosis – Only *Capys stuarti* (Figs 23: male, 41: male genitalia, 47–48: androconia) and *C. vorgasi* (Figs 20–22: males, 27–28: females, 40: male genitalia, 45–46 and 49–52: androconia, 65–66: palps) were known to occur in West Africa, and *C. smithi* sp. n. differs from both by the duller brownish coppery patches on the dorsal wing surfaces, which are brighter red in *C. vorgasi* and paler orange in *C. stuarti*. Males vary significantly in size, most likely depending on food availability. Colouration pattern do not seem to vary among the three males available for examination. Contrary to the diagnoses provided by Collins & Larsen (2000) and Larsen & Collins (2003), an androconial patch appears in the fork of veins 6 and 7 on the dorsal surface of the hindwing in males of both *C. stuarti* and *C. vorgasi*, although it is much reduced in size and inconspicuous in the latter species, largely restricted to the triangular area between these two veins, visible only under high magnification (width of patch = 1 mm along the vein on the illustrated specimen). In the examined specimens of *C. vorgasi* the androconia are larger (width = 2 mm along the vein of the holotype) and are visible to the naked eye, while androconia are small and inconspicuous in *C. smithi* sp. n. (width >1 mm in the holotype, width = 1 mm in the paratypes). *Capys smithi* sp. n., as expected, seems to be a sister species of *C. vorgasi* and *C. stuarti*, according to the results of the COI analysis. In the COI section of mithochondrial DNA sequence, *C. smithi* sp. n. differs only slightly from *C. stuarti* by 0.03% and from *C. vorgasi* by 0.12% by K2P distances.

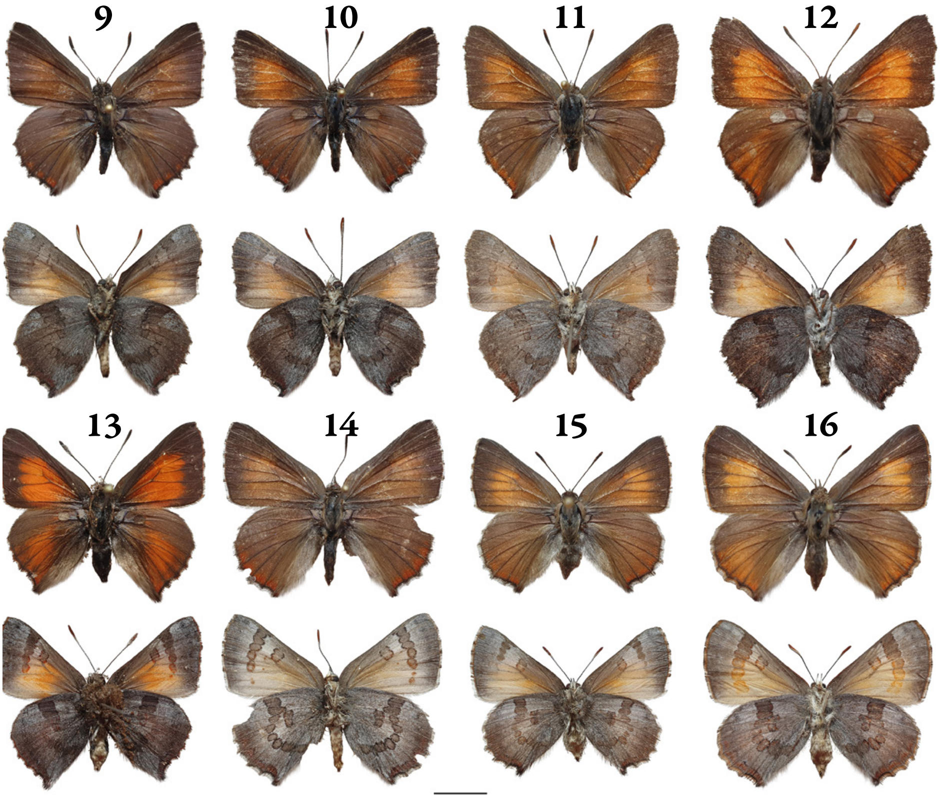
Description – Male: Labial palp second segment short with ribbon-like scales, third segment 1/4× as long as the second segment (Figs 63–64). Forewing length: 13.4–20.2 mm. Wingspan (n = 3): 26.5–38.5 mm. Forewing outer margin very slightly concave between veins 2 and 4. A narrow patch present in the median area of the forewing dorsal surface, tapering towards the inner margin, another patch being present on the outer half of the hindwing. These patches dull deep reddish orange in colour, with the brown veins across being moderately conspicuous only on hindwing. Reddish patch of forewing with a slight v-shaped incision on its inner margin along vein 2. A minute, but visible (width = 1 mm) androconial patch being present in the subbasal area of the hindwing dorsal surface, in the fork of veins 6 and 7. Ground colour of ventral surface pale graphite-grey, with a shade of orange identical to forewing. In the hindwing the bands formed by darker pearly spots being very poorly developed and not complete. Some spots sparsely overlayed by dull reddish scales. Margin with a row of dull reddish lunules in spaces 1b, 2, 3 and 4, sometimes missing or forming a sub-marginal reddish band. Rest of the submarginal area slightly darker than rest of the wing (Figs 17–18, 43–44). Groundplan of genitalia similar to other *Capys* species with the dorsally bi-lobed and sparsely setose uncus, slender upcurving brachia in lateral view, characterless tegumen and rudimental, basally fused lanceolate valvae, with only a few fine hairs on their terminal half. Aedeagus straight and 1.5 times longer than the entire genital capsule, with slightly bent subzonal portion terminus in lateral view. Vesica with a single membraneous cornutus (Figs 38–39). Female: Appearance almost identical to *C. vorgasi* and *C. stuarti*. Ground colour on both surfaces slightly lighter than the other two species, and the pearly pattern on the ventral surface on the hindwing less conspicuous (Figs 25–26).

Etymology – The species is dedicated to Richard Smith, Chairman of the Board of Trustees, ANHRT for his continued dedication to and support of taxonomy and Afrotropical entomology.

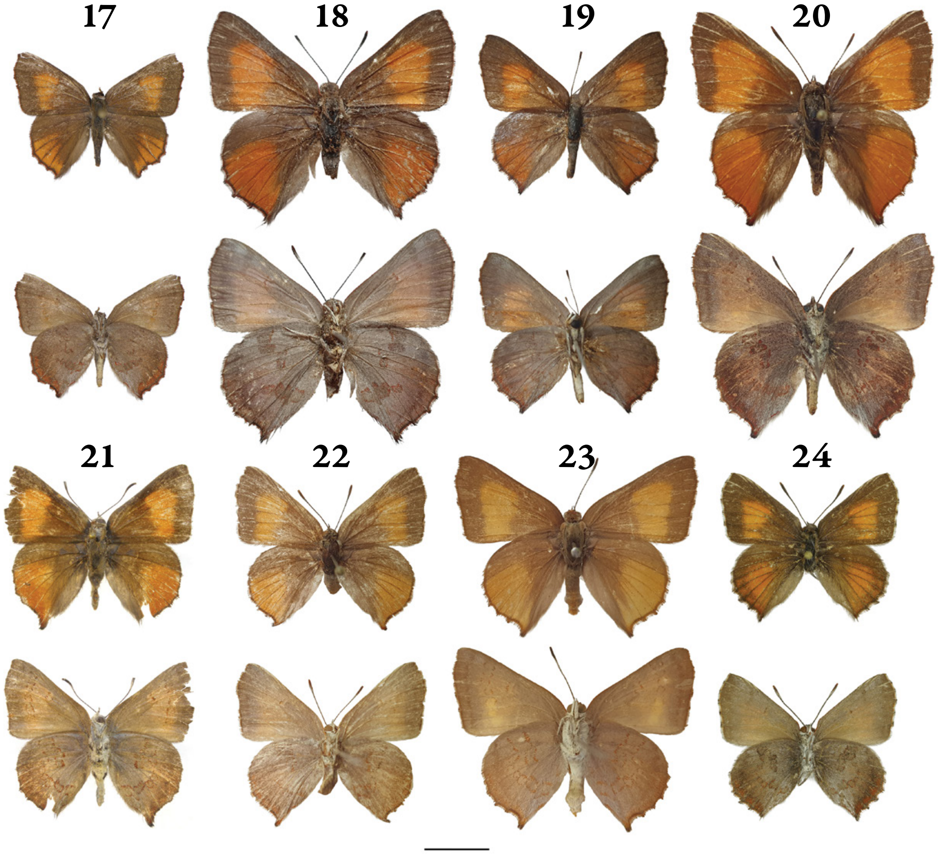
Remarks – Previously, only two *Capys* species were known from West Africa: (1) *Capys stuarti*, described and known only from the Jos Plateau of central-northern Nigeria, and (2) the more recently discovered *C. vorgasi*, which was collected only from hilly localities in the Likpe Mountains, Volta Region, Ghana. The Likpe region is part of the broader Togo Mountains, encompassing the Volta biogeographical subregion, a rather large, isolated and partially forested mountainous area in the Dahomey Gap (LARSEN 2005). Although *Capys* are rarely found in lowland areas, as *Protea* stands usually occur in hills and mountains in East and West Africa, the newly described *C. smithi* sp. n. was found in two lowland localities in typical Guinea savannah in Ghana and Ivory Coast (200–400 m ASL) with different ecological conditions from habitats of other congeners and could be the only truly lowland *Capys* species.



Figures 1–8. *Capys* species, in dorsal (upper image) and ventral (lower image) views. 1 = *C. robertsi* sp. n. (holotype); 2 = *C. robertsi* sp. n. (male paratype, Kenya, Mount Kenya); 3 = *C. meruensis* (male paratype, Kenya, Mount Kenya, Meru); 4 = *C. meruensis* (male, Kenya, Mount Kenya, Meru); 5 = *C. robertsi* sp. n. (female paratype, Kenya, Mount Kenya); 6 = *C. robertsi* sp. n. (female paratype, Kenya, Mount Kenya) ventral surface; 7 = *C. meruensis* (female, Kenya, Mount Kenya, Meru); 8 = *C. meruensis* (female, Kenya, Mount Kenya, Meru) (photos: Sz. Sáfián). Scale bar = 10 mm.

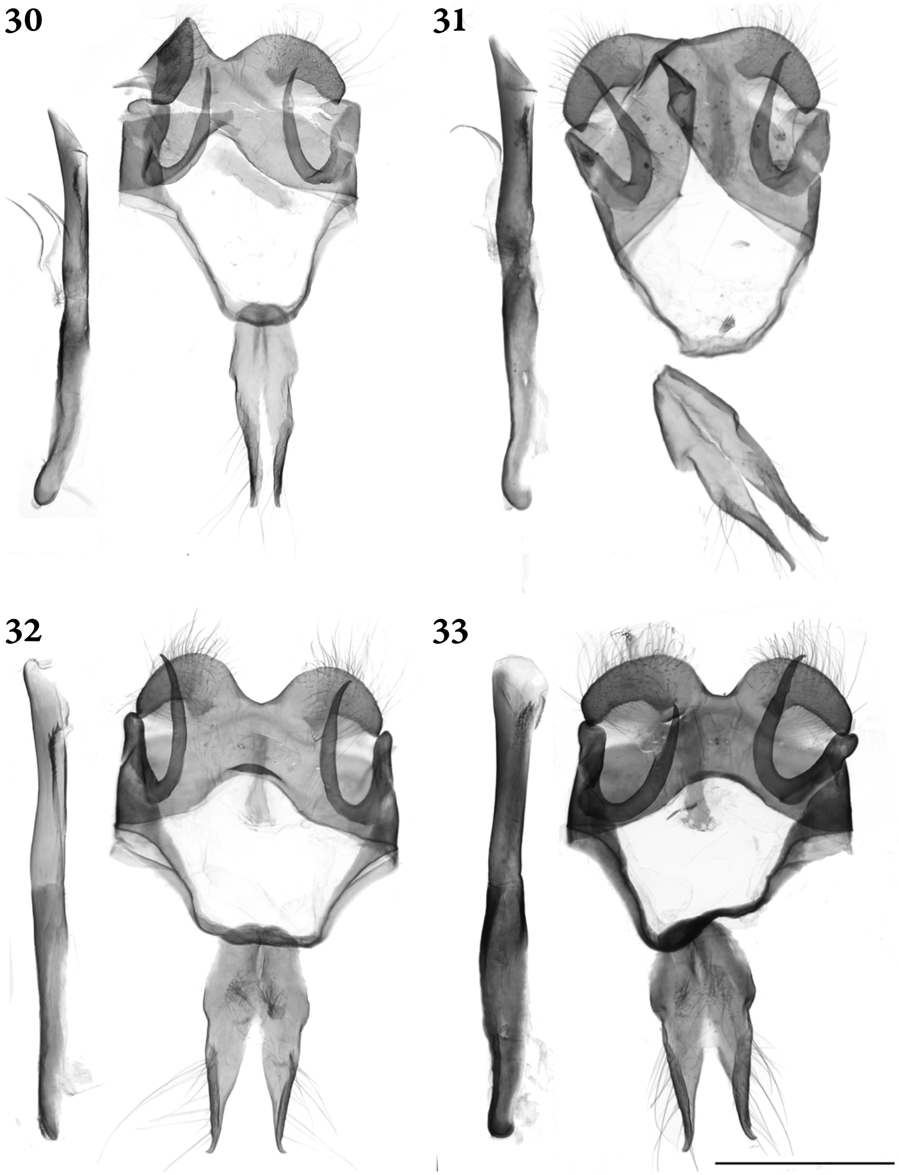


Figures 9–16. *Capys* species, in dorsal (upper image) and ventral (lower image) views. 9 = *C. moroto* sp. n. (holotype); 10 = *C. moroto* sp. n. (male paratype, Uganda, Mount Moroto); 11 = *C.* nr. *moroto* (male, Kenya, Sekerr Mountain); 12 = *C. juliae* (male, Kenya, Mount Cherangani Hills); 13 = *C. juliae* (male, Kenya, Eldoret); 14 = *C. moroto* sp. n. (female paratype, Uganda, Mount Moroto); 15 = *C. juliae* (female, Kenya, Mount Cherangani Hills); 16 = *C. juliae* (female, Kenya, Eldoret) (photos: Sz. Sáfián). Scale bar = 10 mm.

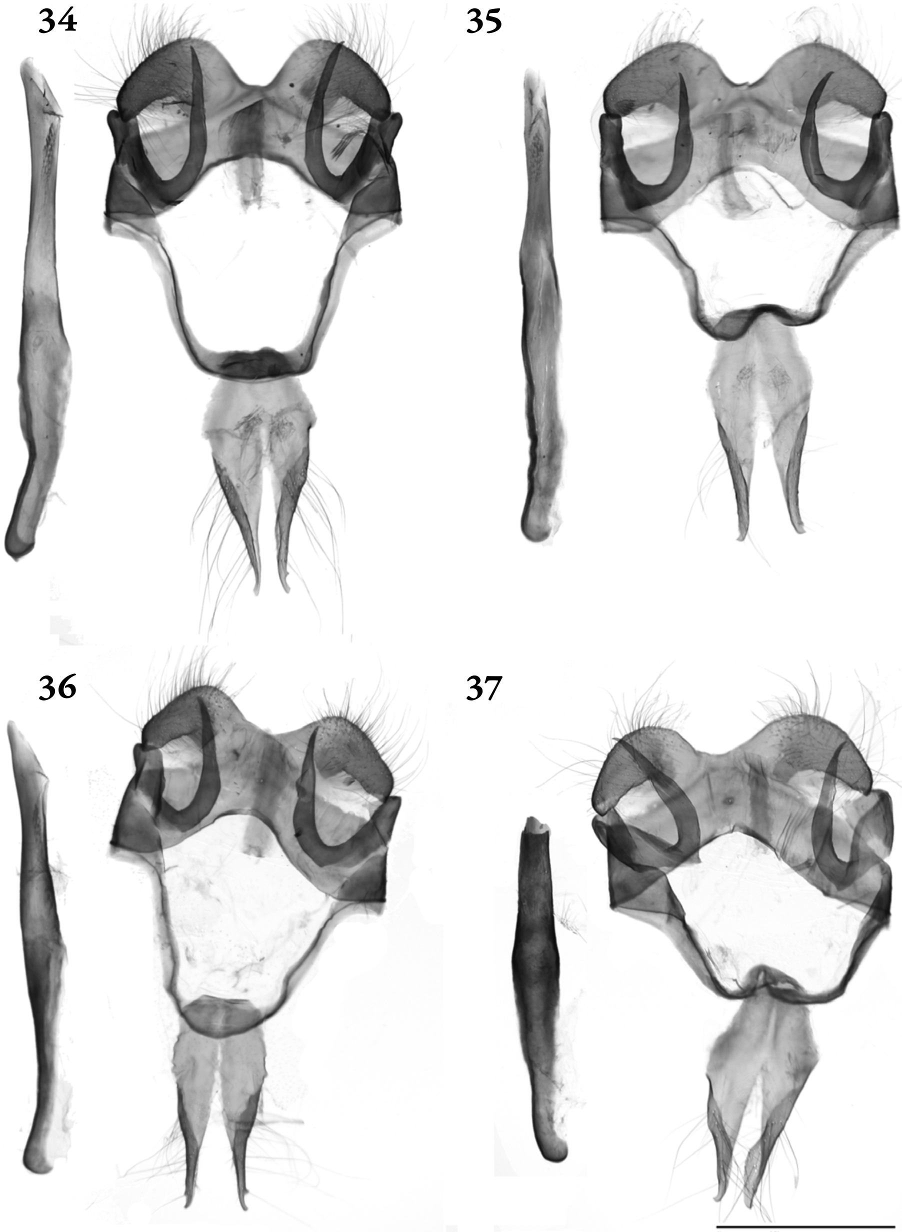


Figures 17–24. *Capys* males, in dorsal (upper image) and ventral (lower image) views. 17 = *C. smithi* sp. n. (holotype); 18 = *C. smithi* sp. n. (paratype, Ghana, Mole); 19 = *C. smithi* sp. n. (paratype, Ghana, Larabanga); 20 = *C. vorgasi* (holotype); 21 = *C. vorgasi* (paratype, Ghana, Likpe); 22 = *C. vorgasi* (Ghana, Kyabobo National Park); 23 = *C. stuarti* (Nigeria, Kaduna); 24 = *C. arba* sp. n. (holotype) (photos: Sz. Sáfián). Scale bar = 10 mm.

Figures 25–29. *Capys* females, in dorsal (upper image) and ventral (lower image) views. 25 = *C. smithi* sp. n. (paratype, Ghana, Larabanga); 26 = *C. smithi* sp. n. (paratype, Ghana, Larabanga), dorsal surface; 27 = *C. vorgasi* (Ghana, Likpe); 28 = *C. vorgasi* (Ghana Likpe); 29 = *C. arba* sp. n. (paratype, Ethiopia, Dorze) (photos: Sz. Sáfián). Scale bar = 10 mm.

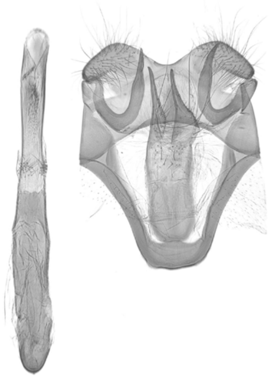


Figures 30–33. Male genitalia of *Capys* species mounted on slides (aedeagus on left and flattened armature on right). 30 = *C. robertsi* sp. n. (holotype); 31 = *C. robertsi* sp. n. (paratype); 32 = *C. meruensis* (Kenya, Mount Kenya); 33 = *C. meruensis* (Kenya, Mount Kenya) (photos: B. Tóth). Scale bar = 1 mm.



Figures 34–37. Male genitalia of *Capys* species mounted on slides (aedeagus on left and flattened armature on right). 34 = *C. moroto* sp. n. (holotype); 35 = *C. moroto* sp. n. (paratype); 36 = *C.* nr. *moroto* (Kenya, Sekerr Mountains); 37 = *C. juliae* (Kenya, Cherangani Hills) (photos: B. Tóth). Scale bar = 1 mm.

38



39

40

41

42a

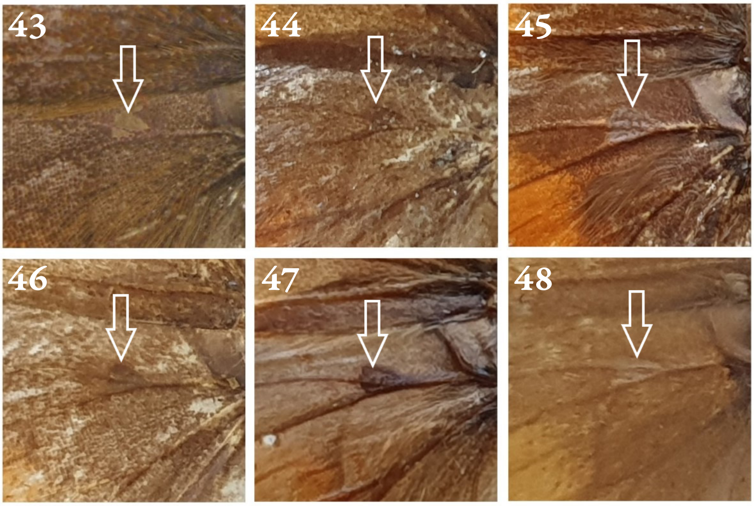
42b

Figures 38–42. Male genitalia of *Capys* species mounted on slides (aedeagus on left and flattened armature on right). 38 = *C. smithi* sp. n. (holotype); 39 = *C. smithi* sp. n. (paratype, Ghana, Larabanga); 40 = *C. vorgasi* (holotype); 41 = *C. stuarti* (Nigeria, Jos Plateau) (photos: B. Tóth); 42 = *C. arba* (holotype in lateral view (a)), plus armature in dorsal view in extreme right (b) (photos: N. Ignatev and M. Rindoš). Scale bars = 1 mm.

DISCUSSION

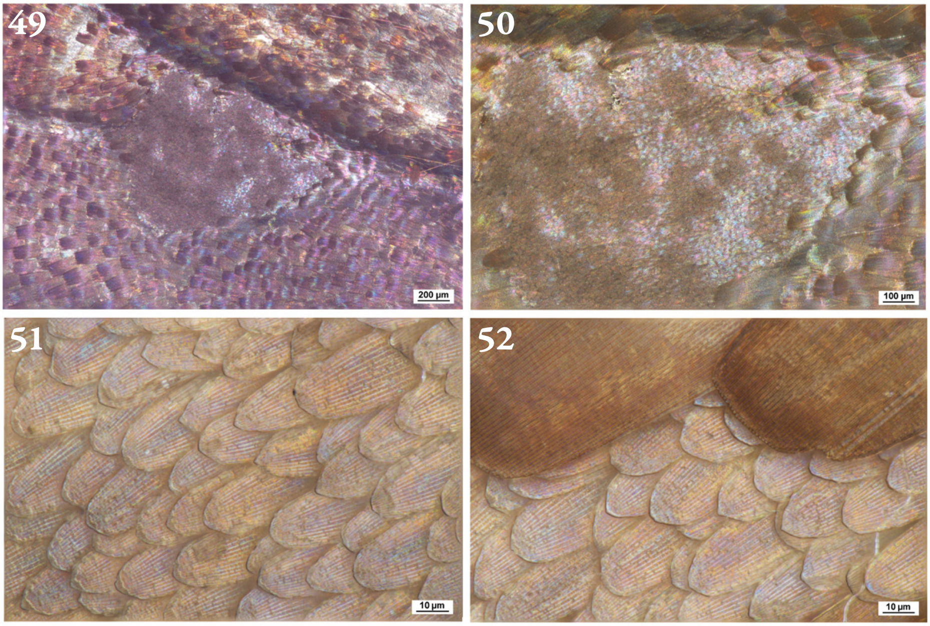
Androconia

Murray (1935) recorded and illustrated the presence of androconia for *Capys* stating that "the scent patch is covered by a brush of long hair-like structures, i.e. setae or modified scales… [but] the brush of prominent bristles is attached to the lower edge of the scent patch itself, on the upper surface of the hindwing and point upwards". Later Stempffer (1967: 171) repeated this observation made on male secondary characters as "on underside of fore wing a tuft of hairs in the middle of the inner margin, on upperside of hind wing a small scaly spot at the origin of vein 7". He remarked that these characters are missing on *C. brunneus* and *C. catharus*. Henning & Henning (1988) used this trait in their "Key for *Capys* species" based on males. However, the presence of hairiness in the middle region of the inner margin of the forewing was erroneously recorded as a tuft of hairs. This latter trait is indeed typical for many deudorigine hairstreaks, but it is completely absent in *Capys* (Figs 43–48). In fact, a series of long hairs is present on the inner margin of the forewing, a trait that is widely distributed in papilionoid butterflies, and can also be found in females, hence it does not necessarily connect to the androconia. Probably it has a mechanical function in helping the synchrony of the movement of the forewing and hindwing musculature.



Figures 43–48. Androconial patch on the hindwing dorsal surface of *Capys* males indicated by an arrow. 43 = *Capys smithi* sp. n., holotype; 44 = *Capys smithi* sp. n., paratype, Ghana, Larabanga; 45 = *C. vorgasi*, holotype; 46 = *C. vorgasi*, Ghana, Likpe; 47 = *C. stuarti,* Nigeria, Jos; 48 = *C. stuarti,* Nigeria, Kaduna (photos Sz. Sáfián); for scale see previous figures.

The "sex patch" of Murray (1935), the "small scaly spot" of Stempffer (1967), and the "scent brand" of Eliot (1973) and Henning & Henning (1988), androconial patch of Collins & Smith (2000) and Larsen & Collins (2003) all refer to a "scent patch" sensu Robbins (1991), as it cannot be detected in the ventral wing surface (Faynel & Bálint 2012). Indeed, it consists of scales which can be considered as androconia as their morphology reveals: the dimensions of these scales are different from the ordinary cover and ground scales (Figs 49–52). Moreover, it is situated on the principal vein which suggests the androconial scales form an organ supported by living cells (Salcedo & Socha 2020, Tsai *et al.* 2020). The form and extension of this scent pad around the (radial) vein 7 erection seems to be species specific, but further investigations on larger sample sizes are necessary.



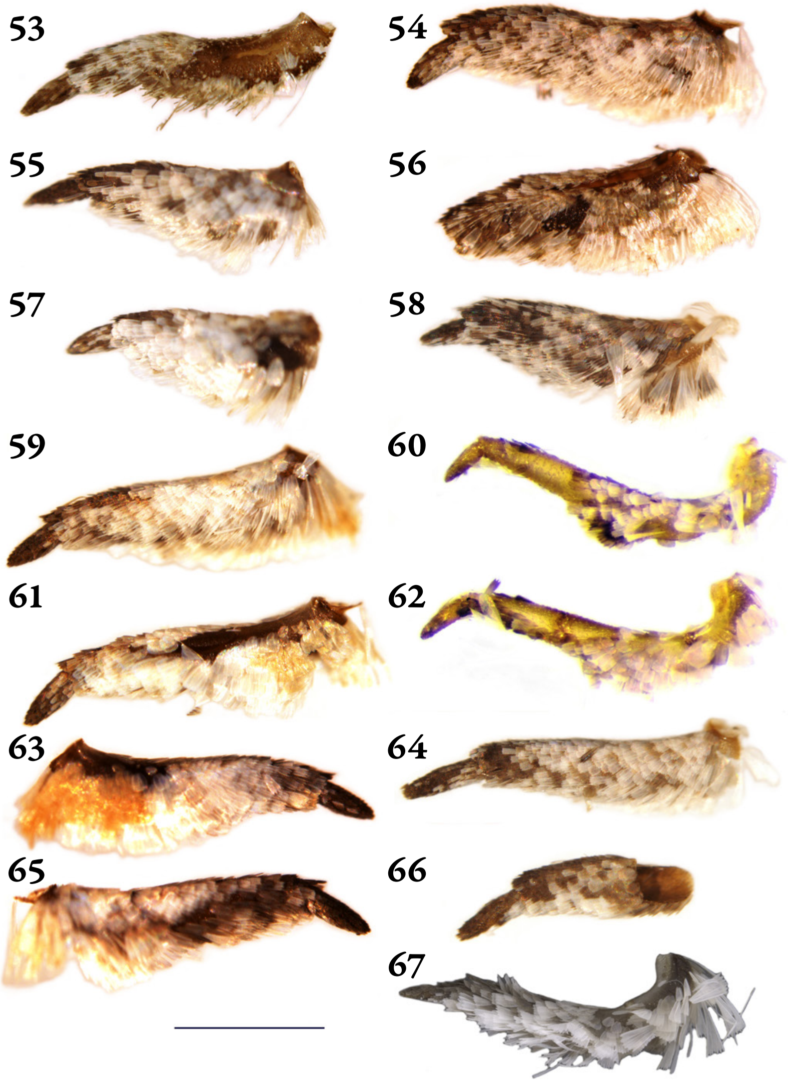
Figures 49–52. Micrographs of scent patch of dorsal surface of hindwing of *Capys vorgasi* (Ghana, Kyabobo), situated at the erection of vein 7 under various magnifications. 49 = the whole patch surrounded by ordinary scales; 50 = only the patch shows various reflectivity, caused by the different position of the scales; 51 = androconia under larger magnification; 52 = pigment-loaded cover scales (upper part) and androconia (lower part), note that the androconial scales are remarkably smaller than ordinary scales and are somewhat different in shape (photos: G. Piszter).

Although most of the *Capys* species possess androconia, there are references to its absence in *C. brunneus*, *C. catharus* and *C. stuarti* (Stempffer 1967, Henning & Henning 1988, Collins & Larsen 2000, Larsen & Collins 2003). However, we present here two remarks which contradict the observations of missing androconia, and underline that the absence or presence of androconia in *Capys* needs further investigation: (1) the examined paratype specimen of *C. stuarti* possesses a minute scent patch in the usual region (Figs 47–48); (2) the documentations provided by Kielland (1998) and d'Abrera (2009) also indicate that *C. brunneus* and *C. catharus* have androconia, but their size is similarly small like that of *C. stuarti,* therefore easy to overlook. Although it is well-known in various Lycaenidae genera that there are congeneric species with and without androconia (cf. Druce 1907, Murray 1935, Bálint *et al.* 2017), this is most probably not the case in *Capys*.

Labial palps

Henning & Henning (1988) presented identification keys separately for males and females of *Capys* species. In the key, "sex brands" (scent patches), wing colouration pattern, traits of labial palps, male and female genitalia were considered to be diagnostic features. Labial palps were documented for twelve taxa in 26 line drawings (Henning & Henning 1988: figs 61–84), but the numbers of the examined specimens were not given and the infraspecific variation was not further elaborated upon. They stated that "palpi with second segment laterally compressed, tapering gradually distally, usually white or pale grey; third segment short in male but longer in female and pale brown to charcoal black in color".

We examined the male palps of seven taxa (Figs 53–67) and our findings correspond with those reported in Henning & Henning (1988): the second segment is laterally compressed, tapering gradually distally and the third segment is short. Nevertheless, we remark here that the basal part of the inner surface of the second segment is covered in different types of dark-coloured (charcoal or dark brown) scales as compared to the rest of the segment, where the scales bear no pigments in their lumen. Although there is a large amount of literature about lepidopteran scales, most of them concentrate on the scales covering the wing membrane. Further investigations are required to describe and understand the different type of scales in palps of *Capys* species we recorded.



Figures 53–67. Labial palps of *Capys* species in lateral view. 53 = *C. moroto* sp. n. (holotype), left palp, inner side; 54 = *C. moroto sp. n.* (paratype), right palp with broken base, inner side; 55 = *C. moroto* sp. n. (paratype), left palp, outer side, left palp with broken base; 56 = *C.* n. *moroto,* left palp, outer side; 57 = *C.* n. *moroto*, right palp, inner side; 58 = *C.* n. *moroto* left palp, inner side; 59 = *C.* n. *moroto*, right palp, outer side; 60 = *C. juliae,* left palp, outer side; 61 = *C. juliae*, right palp, inner side with broken apex; 62 = *C. robertsi* sp. n. (paratype), left palp, outer side; 63 = *C. smithi* sp. n., holotype, left palp, outer side; 64 = *C. smithi* sp. n., holotype, right palp, inner side; 65 = *C. vorgasi*, left palp, outer side, 66 = *C. vorgasi*, right palp with broken base, inner side (photos: Zs. Bálint), 67 = *C. arba* sp. n., right palp, outer side (photo: N. Ignatev and M. Rindoš). Scale bar = 1 mm.

Characteristics of male genitalia

Stempffer (1967) stated that the male genitalia of *Capys* species are basically similar, however he pointed out some useful characters. Henning & Henning (1988) expressed the opinion that the slight observed differences were not species specific. In spite of this remark, they used male genitalia characters in their species descriptions, such as width and shape of valva, size of vesica and the associated cornutus, and width of brachia. Descriptions presented after 1988 all emphasised that "there appear to be no significant differences between male genitalia in *Capys*" (Collins & Larsen 2000). According to our experience, male genitalia exhibit minor but, in some cases, very distinctive characteristics, especially in the shape of the aedeagus and valvae in lateral view, and thus they were used in our diagnoses. A statistical analysis of male genitalia traits certainly could yield results which may work together well with the female genitalia characteristics used in identification of the species of the genus by Henning & Henning (1988).

COI maximum likelihood tree

COI-based maximum likelihood analysis was performed mainly to understand the genetic distance and position between the very similar West African *Capys* taxa. Despite the generally low K2P distances among the taxa, which is however usual within Theclini (Busby *et al.* 2017), the results fully support the distinctness and validity of *C. stuarti* and *C. vorgasi*, as well as the newly described *C. smithi* sp. n. (Fig. 68). It must be noted that due to incomplete taxon sampling, the true relationship of the latter to other species of the genus is only tentative. Interestingly, the COI sequence obtained from a single *C. disjunctus*, collected recently by the first author, took a very distant (1.852%) position from those accessed through BOLD and indeed, examination of the supporting photo material (illustrated only via a recto surface on BOLD) revealed that these specimens (collected in the Katanga Region of DRC) belong to a species of very different appearance, potentially to *C. brunneus heathi* or *C. catharus*, both of which occur in neighbouring Zambia, or to a yet undescribed similar taxon.

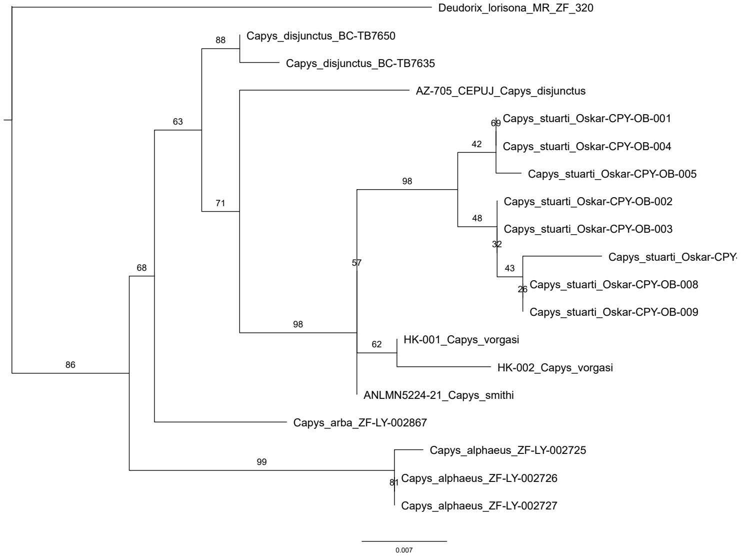


Figure 68. Maximum likelihood tree of the barcoded *Capys* species, including *C. arba* sp. n. and *C. smithi* sp. n.

Notes on the biogeography

In sub-Saharan Africa species distribution of butterflies is still under-documented and therefore biogeographical boundaries are usually poorly understood, and even more vaguely defined (Larsen 2005, Sáfián 2021). This is particularly important in the case of the West African *Capys*, which are clearly closely related (differing mainly in androconia and colour shades of males and only slightly in the COI gene region). They also utilise the same foodplant, *Protea madiensis occidentalis*, but are very clearly separated geographically (Figs 69–70).

In the case of *Capys smithi* sp. n., the populations are also separated ecologically from those of *C. vorgasi* and the limits between these taxa are well defined (as reflected in their differences discussed above), despite relative spatial proximity between them. The species *C. stuarti* is known only from the central-northern highlands of Nigeria (Jos Plateau), completely isolated from the neighbouring species, *C. bamendanus*, which was described and is still known only from the western and northern highlands of Cameroon (Bamenda Highland, Adamawa Plateau). The distribution of *C. vorgasi* is also separate, according to present knowledge, restricted to the upland plateaus and hills of the Togo Mountains (so far documented only from the eastern border area of Ghana but may also occur in Togo) (Larsen 2005).

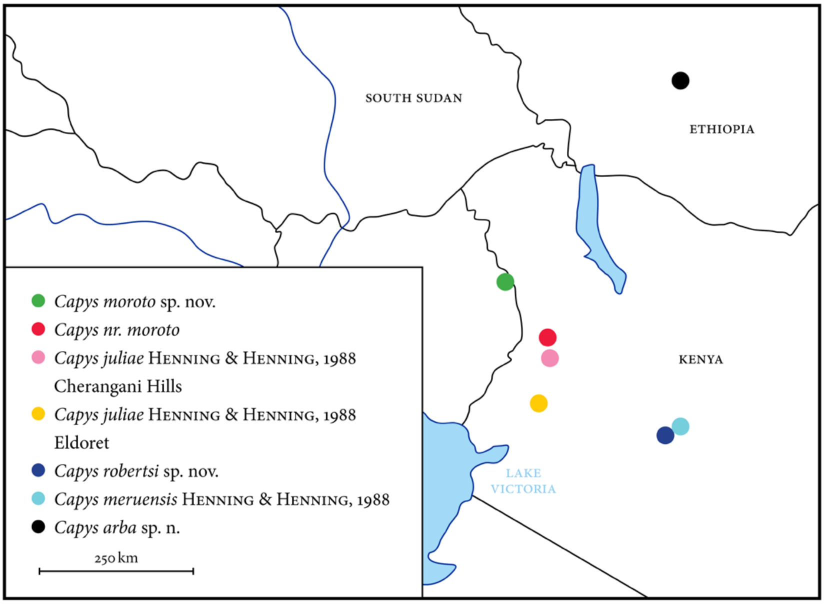


Figure 69. Type localities of *Capys arba* sp. n., *C. robertsi* sp. n., and *C. moroto* sp. n. and known occurrences of other congeners.

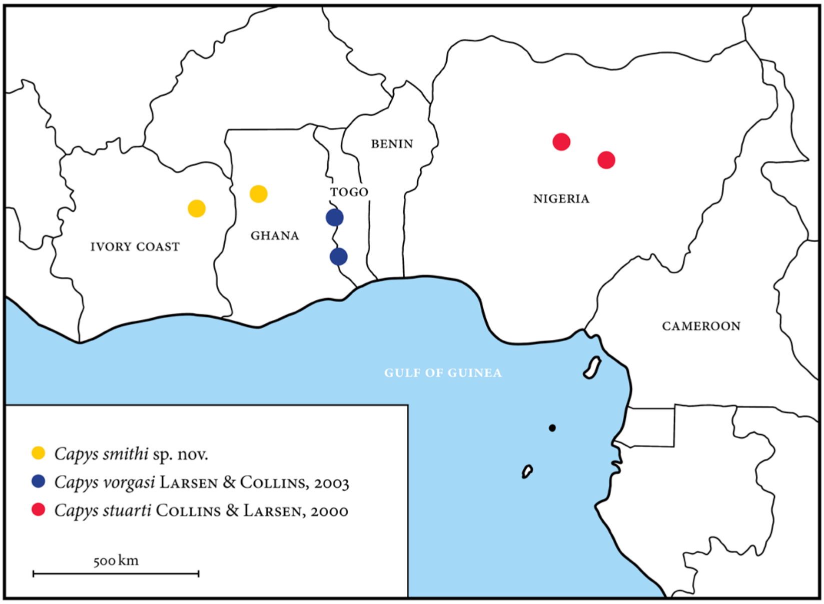


Figure 70. Known localities of *Capys smithi* sp. n., and occurrences of similar congeners.

71

72

73

74

Figures 71–74. Habitat and hostplant of *C. smithi* sp. n., and its conservation threats in Larabanga, Ghana. 71 = *C. smithii* sp. n. (female) in nature on hostplant *Protea madiensis occidentalis* (photo: Clement O. Selorm); 72 = *Protea madiensis occidentalis* bush; 73 = habitat of *C. smithi* sp. n., threatened by regular burning; 74 = clearing of *Protea* bushes turns the site suitable for farming (photos: Sz. Sáfián).

The newly described *C. smithi* sp. n. is apparently a lowland species, adapted to much drier and warmer climatic conditions in the Guinea savannah zone of central-northern Ghana and eastern-central Ivory Coast, where the foodplant also has unusual lowland occurrences.

The nominotypical population of *C. smithi* sp. n. occurs west of the Volta River system, and the Ghanaian population lies to the west of the White and Red Volta confluence and north of the Black Volta, almost directly connected to the type population through the Guinea savannah landscape. The Volta River system is a well-recognised boundary of distribution of numerous forest butterflies (Larsen 2005, Libert 2010, 2014, 2020, Sáfián 2021) as well as other forest-dwelling animals, and the forest area west of the river is widely recognised as the Upper Guinean Forest Zone. The biogeographical significance of the River Volta is poorly understood in the Guinea Savannah Zone, but generally, those butterfly species of restricted range and those with specialised life history e.g. monophagy in West African savannahs, are very scarce. *Capys* seem to be unique in both and might well become indicators of biogeographic separation within the West African Guinea savannah zone.

The Jos Plateau in north-central Nigeria is a completely isolated block of mountains of Cambrian, Ordovician and Jurassic granite formations (Couvreur *et al.* 2021), separated from the Nigeria-Cameroon Highlands by a broad stretch of lowland savannah, and also by the Benue River. It is highly possible that further undescribed species will be found in mountainous areas in Africa and therefore newly discovered populations should be carefully examined while the apparently disjunct distributional areas should be revisited and reassessed. There is some urgency as most of the *Protea* dominated habitats are being cleared for potential agriculture (Figs 71–74).

*

Authorship contributions – conceptualisation: Sz. Sáfián Zs. Bálint; Correcting and editing: Zs. Bálint, S. C. Collins, Z. F. Fric, G. Katona, G. Piszter, Sz. Sáfián, H. Takano, B. Tóth; methodology: Zs. Bálint, Z. F. Fric, G. Katona, G. Piszter, Sz. Sáfián, B. Tóth; resources: Zs. Bálint, S.C. Collins, Z. F. Fric, Sz. Sáfián, H. Takano; writing original draft: Sz. Sáfián. All authors have read and agreed to the published version of the manuscript.

Orcids – Zsolt Bálint: https://orcid.org/0000-0001-8174-878X;
Steve C. Collins: https://orcid.org/0000-0001-8018-5997;
Gergely Katona: https://orcid.org/ 0000-0002-3161-8060;
Zdenek Faltynek Fric: https://orcid.org/ 0000-0002-3611-8022;
Szabolcs Sáfián: https://orcid.org/0000-0002-0614-4203;
Hitoshi Takano: https://orcid.org/ 0000-0002-2627-4881;
Balázs Tóth: https://orcid.org/ 0000-0002-6089-1218.

Acknowledgements – The authors thank Manfred Georg Ströhle (Weiden, Germany) for sending images of *C. arba* specimens for the description and for photos of the *C. vorgasi* scent patch, Gyula M. Laszlo and Hana Konvickova for the dissection and photography of the genitalia of the *C. smithi* and *C. arba* holotypes, respectively, and to Nikolai Ignatev and Michael Rindos for kindly assisting with the barcoding. Renátó Molnár (Biatorbágy, Hungary) kindly edited the colour plates and maps. Gábor Piszter is grateful for the support of the János Bolyai Research Scholarship of the Hungarian Academy of Sciences. This research was prepared in the frame of the joint scientific agreement between the HNHM and CER, and was supported by the National Research, Development and Innovation Office of Hungary–NKFIH, project no. OTKA PD 143037.

REFERENCES

Armstrong A. J. 2020: The status and distribution of Pennington's Protea butterfly Capys penningtoni (Lepidoptera: Lycaenidae: Theclinae). – *Metamorphosis* **31**(1): 139–147. https://doi.org/10.4314/met.v31i1.24

Bálint Zs., Gyulai P., Katona G. & Tóth B. 2023: New species and genera described by Dr. Márton Hreblay (1963–2000) in his monograph on North-Thailand noctuid moths (Lepidoptera: Noctuidae).– *Annales Musei historico-naturalis hungarici* **115**: 17–199. https://doi.org/10.53019/AnnlsMusHistNatHung.2023.115.17

Bálint Zs., Heath A., Katona G., Kertész K. & Sáfián Sz. 2017: Male secondary sexual characters in Aphnaeinae wings (Lepidoptera: Lycaenidae). – *Opuscula Zoologica* **48**(1): 27–34. https://doi.org/10.18348/opzool.2017.27

Benyamini D. 2023. *Butterflies of the Levant and nearby areas. Vol. IV. Lycaenidae.* – Microrobotics, Beit Arye, 192 pp.

Busby R. C. , Faynel C., Moser A. & Robbins. R. K. 2017: Sympatric Diversification in the Upper Amazon. A Revision of the Eumaeine Genus Paraspiculatus (Lepidoptera: Lycaenidae). – *Smithsonian Contributions to Zoology* **649**: 1–65.

Collins S. C. & Larsen T. B. 2000: Eight new species and five new subspecies of African butterflies (Rhopalocera), an ABRI research paper. – *Metamorphosis* **11**(2): 57–75.

Congdon, C. & Collins, S. 1998: *Kielland's butterflies of Tanzania. Supplement.* – African Butterfly Research Institute & Union des Entomologistes Belges, Nairobi & Tervuren, 143 pp.

Congdon C., Collins S. C. & Bayliss J. 2010: Butterflies of south east Africa's mountains (Mozambique and Malawi). – *Metamorphosis, Journal of the Lepidopterists' Society of Africa* **21**(2): 46–106.

Couvreur T.L.P., Dauby G., Blach-Overgaard A., Deblauwe V., Dessein S., Droissart V., Hardy O. J., Harris D. J., Janssens S. B., Ley A. C., Mackinder A., Sonké B., Sosef M. S. M., Stévart T., Svenning J.-S., Wieringa J. J., Faye A., Missoup D. A. , Tolley A. K., Nicolas V., Ntie S., Fluteau F., RobinC., Guillocheau F., Barboni D. & Sepulchre P. 2021: Tectonics, climate and the diversification of the tropical African terrestrial flora and fauna. – *Biological Reviews* **96**: 16–51. https://doi.org/10.1111/brv.12644 d'Abrera B. 2009: *Butterflies of the Afrotropical Region Part III Lycaenidae, Riodinidae.* – Hill House Publishers, Melbourne & London, pp. 531–880.

de Queiroz K. 2007: Species concepts and species delimitation. – *Systematic Biology* **56**: 879–886.
https://doi.org/10.1080/10635150701701083

Druce H. H. 1907: On Neotropical Lycaenidae, with descriptions of new species. – *Proceedings of the zoological Society of London* **1907**(3): 566–632, pls 31–36.
https://doi.org/10.1111/j.1469-7998.1907.tb06947.x

Eliot J. N. 1973: The higher classification of the Lycaenidae (Lepidoptera): a tentative arrangement. – *Bulletin of the British Museum of Natural History (Entomology)* **28**: 371–505.
https://doi.org/10.5962/bhl.part.11171

Heath A., Newport M.A. & Hancock D. 2002: *The butterflies of Zambia.* – African Butterfly Research Institute and The Lepidopterists' Society of Africa, 137 pp. + CD-ROM.

Henning G. A. & Henning S. F. 1988: A review of the genus *Capys* Hewitson (Lepidoptera: Lycaenidae) with descriptions of seven new species and two new subspecies. – *Durban Museum Novitates* **14**(2): 102–139.

Hebert P. D., Braukmann T. W., Prosser S. W., Ratnasingham S., DeWaard J. R., Ivanova N. V., Janzen D. H., Hallwachs W., Naik S., Sones J. E. & Zakharov E.V. 2018: A Sequel to Sanger: amplicon sequencing that scales. – *BMC genomics* **19**: 1–14.

Heppner J. B. 1998: Classification of Lepidoptera. – *Holarctic Lepidoptera* **5**(Supplement 1): 1–148 (+ 6 pp).

Kalyaanamoorthy S., Minh B., Wong T., von Haeseler A. & Jermiin L. S. 2017: ModelFinder: fast model selection for accurate phylogenetic estimates. – *Nature Methods* **14**(6): 87–589.
https://doi.org/10.1038/nmeth.4285

Kearse M., Moir R., Wilson A., Stones-Havas S., Cheung M., Sturrock S., Buxton S., Cooper A., Markowitz S., Duran C., Thierer T., Ashton B., Meintjes P. & Drummond A. 2012: Geneious basic: an integrated and extendable desktop software platform for the organization and analysis of sequence data. – *Bioinformatics* **28**(12): 1647–1649.
https://doi.org/10.1093/bioinformatics/bts199

Kielland J. 1999: *Butterflies of Tanzania.* – Hill House Publishers, Melbourne-London, 363 pp., 68 pls, 179 figs.

Larsen T. B. 1991: *The Butterflies of Kenya and their Natural History.* – Oxford University Press, Oxford, 490 pp. + 22 colour pls.

Larsen T. B. 2005: *Butterflies of West Africa.* – Apollo Books, Svendborg, Denmark, 595 pp. + 135 colour plates.

Larsen T. B. & Collins S. 2003: Capys vorgasi Larsen & Collins, sp. n., pp. 93–94. In: Collins, Larsen & Warren-Gash: Notes on Afrotropical butterflies with the description of eleven new species and four new subspecies (Lepidoptera: Rhopalocera). ABRI Research Paper No. 3. – *Metamorphosis* **14**(3): 63–110.

Libert M. 2010: *Révision des Anthene africains (Lepidoptera, Lycaenidae).* – African Butterfly Research Institute, Nairobi & Lambillionea, 420 pp. + 32 pls.

Libert M. 2014: *Sur la taxonomie du genre Celaenorrhinus Hübner en Afrique (Lepidoptera, Hesperiidae).* – African Butterfly Research Institute, Nairobi, 272 pp. + 26 pls.

Libert M. 2020: *Mise à jour de la Révision des Epitola s. l. (Lepidoptera: Lycaenidae).* – Published by Author, 157 pp. + 10 pls.

Miller L. D. 1970: Nomenclature of wing veins and cells. – *Journal of Research on the Lepidoptera* **8**: 37–48.
https://doi.org/10.5962/p.333547

Monteiro A. & Pierce N. E. 2001: Phylogeny of Bicyclus (Lepidoptera: Nymphalidae) Inferred from COI, COII, and EF-1α Gene Sequences. – *Molecular Phylogenetics and Evolution* **18**(2): 264–281.
https://doi.org/10.1006/mpev.2000.0872

Nguyen L.-T., Schmidt H. A., von Haeseler A. & Minh B. K. 2015: IQ-TREE: A Fast and Effective Stochastic Algorithm for Estimating Maximum-Likelihood Phylogenies. – *Molecular Biology and Evolution* **32**(1): 268–274.
https://doi.org/10.1093/molbev/msu300

Murray R. D. 1935: *South African Butterflies. A Monograph of the Family Lycaenidae. With a description and illustration of every species and figures of many larvae.* – Staples Press Limited, London, vii + 195 pp., 144 figs.

Robbins R. K. 1991: Evolution, Comparative Morphology, and Identification of the Emaeine Butterfly Genus Rekoa Kay (Lycaenidae: Theclinae). – *Smithsonian Contributions for Zoology* **498**: i–iii, 1–64 pp.
https://doi.org/10.5479/si.00810282.498

Robbins R. K. 2010: The „upside down" systematics of hairstreak butterflies (Lycaenidae) that eat pineapple and other Bromeliaceae. – *Studies on Neotropical Fauna and Environment* **45**: 21–37.
https://doi.org/10.1080/01650521003751712

Robbins R. K., Cong Q., Zhang J., Shen J., Busby C. R., Faynel C., Duarte M., Martins P. R. A., Prieto C., Lamas L. & Grishin V. N. 2022: Genomics-based higher classification of the species-rich hairstreaks (Lepidoptera: Lycaenidae: Eumaeini) – *Systematic Entomology* **47**(3) 445–469.
https://doi.org/10.1111/syen.12541

Rourke J. P. 1998: A review of the systematics and phylogeny of the African Proteaceae. – *Australian Systematic Botany* **11**(4): 267–285.
https://doi.org/10.1071/SB97027

Salcedo, M. K., Socha, J. J., 2020: Circulation in insect wings: a review on the necessity of hemodynamics in wing functionality. – *Integrative and Comparative Biology.* **60**(5): 1–13.
https://doi.org/10.1093/icb/icaa124

Sáfián Sz. 2020: Taxonomical notes on the Liptena augusta and L. batesana species complexes with description of four new species (Lepidoptera, Lycaenidae, Poritiinae). – *Annales Musei historico-naturalis hungarici* **112**: 105–124.
https://doi.org/10.53019/AnnlsMusHistNatHung.2020.112.105

Sáfián Sz. 2021: *The butterflies (Lepidoptera: Rhopalocera) of Liberia.* – PhD dissertation. University of Sopron, 252 pp + 102 pls.

Stempffer H. 1967: The genera of the African Lycaenidae (Lepidoptera: Rhopalocera). – *Bulletin of the British Museum (Natural History) (Entomology)* **10**: 1–332.
https://doi.org/10.5962/p.145446

Tamura K., Stecher G., Kumar S. 2021: MEGA11: molecular evolutionary genetics analysis version 11. – *Molecular Biology and Evolution* **38**: 3022–3027.
https://doi.org/10.1093/molbev/msab120

Tsai C. C., Childers R. A., Nan Shi N., Ren C., Pelaez J. N., Bernard G. D. & Pierce N. E. 2020: Physical and behavioral adaptations to prevent overheating of the living wings of butterflies. – *Nature Communications* **11**: 551.
https://doi.org/10.1038/s41467-020-14408-8

Tsubaki Y., & Matsumoto K. 1998: Fluctuating Asymmetry and Male Mating Success in a Sphragis-Bearing Butterfly *Luehdorfia japonica* (Lepidoptera: Papilionidae). – *Journal of Insect Behavior* **11**: 571–582 (1998).
https://doi.org/10.1023/A:1022371531263

Vila R. B., Bell, C. D., Macniven R., Goldman-Huertas B., Ree R. H., Marshall C. R., Bálint, Zs., Johnson, K., Benyamini, D. & Pierce N. E. 2011: Phylogeny and palaeoecology of Polyommatus blue butterflies show Beringia was a climate-regulated gateway to the New World. – *Proceedings of the Royal Society B*: *Biological Sciences* **278**: 2737–2744.
https://doi.org/10.1098/rspb.2010.2213

Wahlberg N. & Wheat C. W. 2008: Genomic outposts serve the phylogenomic pioneers: designing novel nuclear markers for genomic DNA extractions of Lepidoptera. – *Systematic Biology* **57**: 231–242.
https://doi.org/10.1080/10635150802033006

Winter D. W. Jr. 2000: Basic Techniques for Observing and Studying Moths & Butterflies. – *Memoirs of the Lepidopterists' Society* **5**: 1–444.

Williams C. M. 2023: Afrotropical Butterflies. Lycaenidae, Theclinae, Genus Capys. https://www.metamorphosis.org.za/articlesPDF/1230/246%20Genus%20Capys%20Hewitson.pdf (accessed: 2023.01.05)

…•••…

Négy új Capys-faj leírása Kelet- és Nyugat-Afrikából, a lepkék morfológiájával és életföldrajzával kapcsolatos jegyzetekkel (Lepidoptera, Lycaenidae, Theclinae)

SZABOLCS SÁFIÁN[1,2] *, STEVE C. COLLINS[1], HITOSHI TAKANO[3], ZDENEK FALTYNEK FRIC[4], BALÁZS TÓTH[2], GERGELY KATONA[2], GÁBOR PISZTER[5], ZSOLT BÁLINT[2]

[1] *African Butterfly Research Institute, P.O. Box 14308, 0800 Nairobi, Kenya.*
E-mail: collinsabri@gmail.com; szsafian@gmail.com
[2] *Magyar Természettudományi Múzeum, Állattár, 1088 Budapest, Baross utca 13, Magyarország.*
E-mail: katona.gergely@nhmus.hu; toth.balazs@nhmus.hu; balint.zsolt@nhmus.hu;
[3] *African Natural History Research Trust, Street Court, Kingsland, Leominster,*
Herefordshire, HR6 9QA, Egyesült Királyság. E-mail: hitoshi.takano@anhrt.org.uk
[4] *Biolog Centre CAS, Branisovska 31, CZ-37005 Ceske Budejovice, Csehország.*
E-mail: fric@entu.cas.cz
[5] *HUN-REN Energiatudományi Kutatóközpont, Műszaki Fizikai és Anyagtudományi Intézet,*
1121 Budapest, Konkoly Thege út 29–33, Magyarország.
E-mail: piszter.gabor@ek.hun-ren.hu; balint.zsolt@ek.hun-ren.hu

Összefoglalás – Az afrikai Deudorka-rokonúak (Deudorigini) tribusz *Capys* nemzetségét képviselő négy új faj kerül leírásra: *C. arba* Sáfián et Fric, sp. n. (típuslelőhely: Etiópia, Dorze Lodge), *C. robertsi* Collins et Sáfián, sp. n. (típuslelőhely: Kenya, Mount Kenya, Marania Bredt feletti láp), *C. moroto* Sáfián et Collins, sp. n. (típuslelőhely: Uganda, Mount Moroto), valamint *C. smithi* Takano et Sáfián, sp. n. (típuslelőhely: Elefántcsontpart, Comoé Nemzeti Park). Áttekintésre kerülnek a *Capys* fajok diagnosztizálására és elkülönítésére korábban alkalmazott morfológiai jellemzők, úgymint a szklerotizálódott hím ivarszervek a potrohban, androkóniális pikkelyek a hátulsó szárnyak felszínén és a fejen levő ajaktapogatók. Az újonnan leírt fajok életföldrajza is tárgyalás alá kerül a molekuláris adatok elemzésének fényében. 74 ábrával.

Kulcsszavak – ajaktapogatók, androkónia, *Capys arba* sp. n., *Capys moroto* sp. n., *Capys robertsi* sp. n., *Capys smithi* sp. n., COI vonalkódok, endofágia, hímivarszerv, illatfolt, *Protea*

---

* levelező szerző.

ÁBRAALÁÍRÁSOK

1–8. ábrák. *Capys* imágók szárnyainak felszíne (fenti kép) és fonákja (alsó kép).
9–16. ábrák. *Capys* imágók szárnyainak felszíne (fenti kép) és fonákja (alsó kép).
17–24. ábrák. *Capys* hím imágók szárnyainak felszíne (fenti kép) és fonákja (alsó kép).
25–29. ábrák. *Capys* nőstény imágók szárnyainak felszíne (fenti kép) és fonákja (alsó kép).
30–33. ábrák. *Capys* hím imágók ivarszervei tárgylemezen (aedeagus balra, fogókészülék jobbra).
34–37. ábrák. *Capys* hím imágók ivarszervei tárgylemezen (aedeagus balra, fogókészülék jobbra).
38–42. ábrák. *Capys* hím imágók ivarszervei tárgylemezen (aedeagus balra, fogókészülék jobbra).
43–48. ábrák. *Capys* hím imágók illatfoltja a hátulsó szárny felső szegélyterében.
49–52. ábrák. A *Capys vorgasi* (Ghána, Kyabobo) hátulsó szárny felszínének szegélytéri illatfoltja, amely a 7. ér tövénél található, különböző nagyítás alatt. 49 = az egész illatfolt fedőpikkelyek által körülvéve; 50 = csak a folt, amely felülete néhány folton a pikkelyek eltérő helyzete miatt eltérő visszaverődést mutat; 51 = az illatpikkelyek nagyobb nagyítás alatt; 52 = pigmenttel töltött fedőpikkelyek (felső rész) és illatpikkelyek (alsó rész), jól látható, hogy az illatpikkelyek feltűnően kisebbek és némileg eltérő alakúak a fedőpikkelyeknél.
53–67. ábrák. *Capys* imágók ajaktapogatói oldalnézetben.
68. ábra. Vonalkóddal jelölt *Capys* fajok maximális valószínűségi fája, benne a *C. arba* sp. n. és *C. smithi* sp. n. fajokkal.
69. ábra. A *Capys arba* sp. n. és a *C. robertsi* sp. n. típuslelőhelyei és a *C. moroto* sp. n. és más rokon fajok ismert előfordulási pontjai.
70. ábra. A *Capys smithi* sp. n. ismert lelőhelyei és hasonló rokon fajok előfordulási pontjai.
71–74. ábrák. A *C. smithi* sp. n. élőhelye, tápnövénye és veszélyeztetése Larabanga (Ghána) környékén. 71 = *C. smithii* sp. n. (nőstény) élő példány a faj *Protea madiensis occidentalis* tápnövényén (fotó: Clement O. Selorm); 72 = *Protea madiensis occidentalis* bokor; 73 = A *C. smithi* sp. n. élőhelyeit rendszeresen felégetik; 74 = a *Protea*-bokrok irtása alkalmassá teszi a élőhelyet gazdálkodásra (fotók: Sáfián Szabolcs).