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A new species of *Iolaus* Hübner, [1819] (Papilionoidea: Lycaenidae: Theclinae) in the subgenus *Argiolaus* Druce, 1891 from Kenya

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Abstract: A new species in the genus *Iolaus* (Papilionoidea, Lycaenidae, Theclinae) is described from the Gatamaiyu Forest, Aberdare Mountains, Central Highlands, Kenya. Morphologically, *I. gatamaiyu* sp. n. is similar to *I. manasei* Libert, 1993, a species of submontane forests of the Cameroon Highlands, which has very different male genitalia. The male genitalia of the new species are similar to those of *I. crawshayi crawshayi* Butler, 1897, *I. crawshayi littoralis* Stempffer & Bennett, 1958 and particularly to those of *I. crawshayi maureli* Dufrane, 1954. All these subspecies of *I. crawshayi*, however, are morphologically and ecologically distinct. The subgeneric placement of *I. manasei* is also briefly discussed.

Key words: *Iolaus silas* species group, *Iolaus crawshayi maureli*, *Iolaus manasei*, subgenus *Philiolaus*, montane forest, genitalia morphology, larval host plant, Loranthaceae

Citation: Sáfián, Sz. & Collins, S.C. 2022. A new species of *Iolaus* Hübner, [1819] (Papilionoidea, Lycaenidae, Theclinae) in the subgenus *Argiolaus* Druce, 1891 from Kenya. *Metamorphosis* **33**: 42–47.

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INTRODUCTION

The African Butterfly Research Institute (ABRI) in Nairobi hosts a large collection of *Iolaus* Hübner, [1819], collected as adults and also reared from pre-imaginal stages over several decades. Among them, a large number of yet undescribed taxa are present, sometimes in long series, which allows comparison of geographically and ecologically distinct populations of often very similar-looking entities. One of these taxa, collected and bred on its host plant exclusively in the Gatamaiyu Forest, Aberdare Mountains, Central Highlands, Kenya was recognised to be distinct from other relatives by the second author, but due to the lack of previous systematic examination of genitalia structure of other presumably related taxa, the proper taxonomic status of the population could not be established. In this paper, the authors recognise and describe the new species in the subgenus *Argiolaus* Druce, 1891 in comparison with various subspecies of *I. crawshayi* and with *I. manasei*. This paper is part of the ongoing revisional work on the genus *Iolaus*, which is detailed in Sáfián *et al.* (2022)

METHODS AND MATERIALS

Acronyms and abbreviations

ABRI – African Butterfly Research Institute, Nairobi, Kenya

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ANHRT – African Natural History Research Trust, Leominster, UK
CEP-MZUJ – Nature Education Centre, Jagiellonian University, Kraków, Poland
DRC – Democratic Republic of the Congo
MRAC – Royal Museum of Central Africa, Tervuren, Belgium
NHM – Natural History Museum, London, UK

Genitalia dissection, wing venation and digital processing of images

Genitalia of all specimens were dissected at CEP-MZUJ using the methodology described in Sáfián *et al.* (2020, 2021, 2022). References to wing venation follow the simplified "English" or numerical system (Miller 1970), which is also used in other modern works on African butterflies (e.g. Larsen 1991, 2005) The digital images and colour plates were edited in various versions of Adobe Photoshop photo editor and Adobe InDesign layout and page-design software.

Comparative material examined

Iolaus silas (Westwood, [1851])

Line drawing of male genitalia in Stempffer & Bennett (1958).
1♂, 1♀ SOUTH AFRICA in Henning & Henning (1984), including illustration of male genitalia (localities not specified).
1♂ SOUTH AFRICA, Eastern Cape, Qolora MTH, 5.xii.83. Leg.: Dr. I.A. Coetzer. SABCA number: ABRI3306. Gen. prep.: SAFI00162; 1♀ SOUTH AFRICA, Buffalo Pass EL, Cape; 25.ii.79; Leg.: N.J. Duke. SABCA number: ABRI3333. Gen. prep.: SAFI00163. All deposited in ABRI.

I. silarus silarus Druce, 1885

Line drawing of male genitalia in Stempffer & Bennett (1958).
1♂, 1♀ SOUTH AFRICA in Henning & Henning (1984), including illustration of male genitalia (localities not specified).
1♂ ZAMBIA, Samwirang Hill, Mwinilunga, Mwinilunga District, North-western Province. 11.xi.2015. Leg. Sáfián, Sz., Fric, Z. Gen. prep.: SAFI00386. Deposited in ANHRT, ANHRT unique number: ANHRT00056663

I. silarus brainei Henning & Henning, 1984

Holotype, 1♂, 1♀ NAMIBIA, Kombat (paratypes) in Henning & Henning (1984) and Natural History Museum (2014), including illustration of male genitalia of the paratype.

I. crawshayi crawshayi Butler, 1897

1♂ TANZANIA, Dodoma Region, Magubike; 8º18.049′S, 37º13.005′E, 787 m; 20.ii.2010. Ph. Darge. Gen. prep.: SAFI00391, ANHRT unique number: ANHRTUK00056668. Deposited in ANHRT.

I. crawshayi littoralis Stempffer & Bennett, 1958

Line drawing of male (presumably holotype) genitalia in Stempffer & Bennett (1958).
1♂ KENYA, Kwale Province, Kwale 5 km NE, 250–300 m. 15.04.2018. Gen. prep.: 734/21.ii.2020/J.Lorenc. Leg.: T. & J. Pyrcz. Deposited in CEP-MZUJ.

I. crawshayi elgonae Stempffer & Bennett, 1958

Line drawing of male (presumably holotype) genitalia in Stempffer & Bennett (1958).
1♂ KENYA, Mt. Elgon 6500 ft.; bred vii.1976. Leg.: S.Collins. Gen. prep.: SAFI00230. Deposited in ABRI; 1♀ Mt. Elgon 6500 ft.; bred vii.1976; Leg.: S.Collins. Gen. prep.: SAFI00231. Deposited in ABRI.

I. crawshayi maureli Dufrane, 1954

♂ neoallotype ETHIOPIA, Harar, Abyssinie. Leg.: Le Moult. Images were downloaded from the homepage of MRAC:
https://www.africamuseum.be/en/research/collections_libraries/biology/collections/lepidoptera/butterflies/RMCA-0682/taxon

2♂♂, ETHIOPIA, nr. Babile, Harar 4500 ft. Bred 7.ix.1995. Coll.: S.Collins. Gen. prep.: SAFI00216, SAFI00217, 1♀ ETHIOPIA, 30 km SE of Harar; 9°10′, 42° 30′; vi.1990, bred, Coll.: S.Collins, Gen. prep.: SAFI00218 (Figs 1C,F; 2C,F; 3C; 4C, F; 5C; 6C; 7). All deposited in ABRI.

I. nr. *crawshayi maureli* Dufrane, 1954

1♂, 1♀ ETHIOPIA, Lake Tana, Bahir Dar; bred vii.95; Coll.: S.Collins, ABRI leg.: Gen. prep.: SAFI00219, SAFI00220. All deposited in ABRI.
Note: this taxon is specifically distinct from *I. crawshayi maureli* on the basis of male genitalia characters.

Iolaus manasei (Libert, 1993)

Holotype in the original description (Libert, 1993) and the illustration of male in Collins & Larsen (2008).
1♂ CAMEROON, Tabenkem (Mount Tabenken), Northwest Cameroon; 6°31'8.68"N, 10°44'47.42"E; 1800–2200 m asl; ABRI leg. Gen. prep.: SAFI00150; 1♀ CAMEROON, Tabenkem (Mount Tabenken), Northwest Cameroon; ABRI leg.; Gen. prep.: SAFI00151; 4♂♂ CAMEROON, Tabenkem (Mount Tabenken), Northwest Cameroon; ABRI leg. 1997, 2010, 2012; ♂ CAMEROON, Bafut-Nouemba (Bafut-Ngemba Forest), Northwest Cameroon; Leg.: S. Collins; 2♀♀ CAMEROON, Tabenken, Northwest Cameroon; ABRI leg; 3♀♀ CAMEROON, Santa, Northwest Cameroon; i.1996, i–ii.1997; Leg.: S.C. Collins.

(Figs 1B, E; 2B, E; 3B; 4B, E; 5B; 6B, 7). All deposited in ABRI.

Note: On the basis of male genitalia characters as established by Henning & Henning (1984) and examined in all three taxa in the complex (see material above), *I. manasei* is clearly a member of the *I. silas* species group and therefore should be listed in the subgenus *Argiolaus* and not in *Philiolaus* as cited in d'Abrera (2009) and subsequently in Collins *et al.* (2014).

RESULTS

DESCRIPTION OF NEW SPECIES

Genus *Iolaus* Hübner, [1819]
Verzeichniss bekannter Schmetterlinge: 81.
Type-species: *Papilio eurisus* Cramer, by subsequent designation.

Subgenus *Argiolaus* Druce, 1891
Annals and Magazine of Natural History (6) **8**: 143.
Type-species: *Anops silas* Westwood, by original designation.

***Iolaus gatamaiyu* sp. nov. (**Figs: 1A, D; 2A, D; 3A; 4A, 4D; 5A, 6A, 7)
urn:lsid:zoobank.org:act: C1FEFE56-0CD0-45F2-AB0C-F4C7F22A34AF

Type material: Holotype ♂ KENYA, Gatamayu 8000 ft. May 1995. Leg.: S. Collins. Gen. prep.: SAFI00148. Coordinates: 0°57'55.11"S, 36°41'36.53"E, Elevation: 2200–2300 m asl. Deposited in ABRI.
Paratypes: ♀ KENYA, Gatamayu 8000 ft I/1991. Leg.: S. Collins (bred). Gen. prep.: SAFI00149; 27♂♂, 28♀♀ KENYA, Gatamayu 8000 ft (most specimens were bred) various dates between 1991 and 1995; ♀ KENYA Nyabeni 8000 ft. ii.1991. Leg.: S.C. Collins. All deposited in ABRI.

Descriptions
Male facies (Figs 1A, C): Forewing length 17.5 mm, wingspan 33.5 mm. General appearance as for other males in the subgenera *Argiolaus* and *Philiolaus* with black ground colour overlaid by extensive iridescent blue on upperside, and dirty white underside with orange or red sub-marginal lines and two hair-tails at the tip of veins 1 and 3 on the hindwing. Blue colour of bright royal blue tone with no green or silvery tinge. Slightly less than basal half of forewing covered with blue, just covering base of

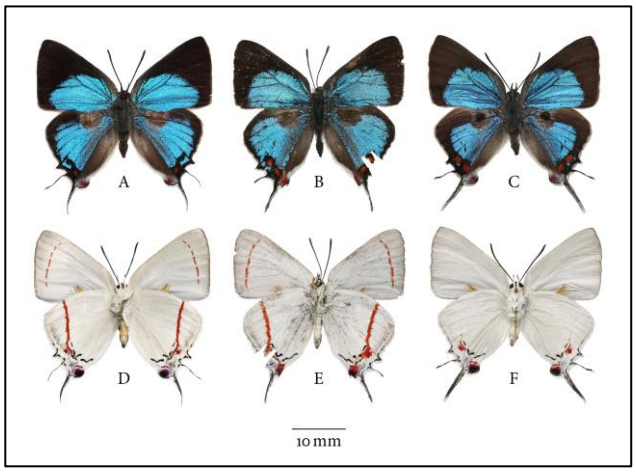

Figure 1 – Male adults: *I. gatamaiyu* (holotype) upperside – A, underside – D; *I. manasei* (Cameroon, Mount Tabenken) upperside – B, underside – E; *I. crawshayi maureli* (Ethiopia, Harar) upperside – C, underside – F.

the fork of veins 3 and 4, except along costa, where black extends almost to base. Outer edge of blue rounded, flatter on costal edge, slightly oblong towards outer margin, widest in space 1B. Hindwing covered almost entirely with blue, except dark grey-black in space 1A, along broad dark grey-black costa and black margin between apex and tornus, which tapers down into a broad black marginal line. Dark red tornal lobe prominent, additional claret-red round-spot present at margin in space 1b, continues in black sub-marginal line that ends at vein 3. Blue scaling quite diffuse in space 6, separated visibly from rest of blue area by strongly blackened vein 6. Androconia circular, dark shiny grey with dark grey, well-defined round heart, covering most of cell and upper part of wing to black-grey costa. Its lower edge speckled with blue scales. Underside dirty white. Forewing with fine, slightly convexly curving claret-red, dashed sub-marginal line between veins 2 and 6, with second and third dashes from inner edge being the two longest. Forewing androconial hair-tuft beige-orange. On hindwing, single, conspicuous, red, concavely curving line present. Outer sub-marginal line absent. Tornal black line fine, broken, spot at end of space 1A mainly black edged with deep red ring, one light blue and another deep red ring basally. Spot in space 2 reduced, dark red, speckled with light blue scales basally, connected to red line. Tails black, with white edge. Fringes (cilia) black, short along outer margin of forewing upperside, longer nearer tornus and along inner edge. Dark grey-black on hindwing, longer lighter grey along inner margin. Fringes grey on forewing underside, white on hindwing. Head, thorax and abdomen black with greyish hairs on upperside, covered by white hairs on thorax underneath, abdomen with brown overlay. Palpi black on top, white below, more than twice as long as diameter of eyes. Eyes smooth, black. Antennae black, speckled with tiny white dots or lines, only slightly thickened towards apex, their length shorter than half of forewing.

Male genitalia (Figs 2A, D; 3A): *Argiolaus*-type. Uncus slightly hairy laterally, bi-lobed with long and down-curving tentacle like tip on each lobe. Sub-unci rudimentary, appearing as two rounded protruson at ventral base of uncus. Saccus strongly reduced, band-like, most visible in posterior view. Valvae triangular, with large

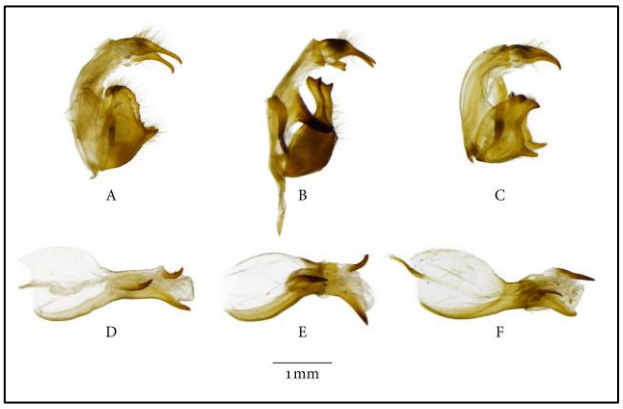

Figure 2 – Male genitalia and aedeagi (laterial view): *I. gatamaiyu* (holotype, Gen. prep.: SAFI00148) – A, F; *I. manasei* (Cameroon, Mount Tabenken, Gen. prep.: SAFI00150) – B, E; *I. crawshayi maureli* (Ethiopia, Harar, Gen. prep.: SAFI00216) – C, F.

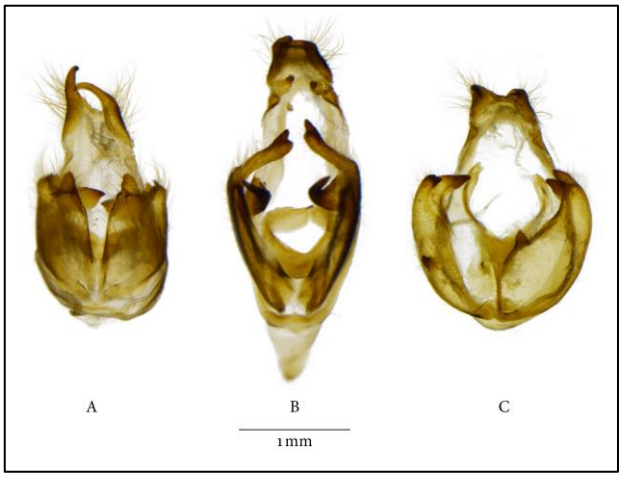

Figure 3 – Male genitalia (posterior view): *I. gatamaiyu* (holotype, Gen. prep.: SAFI00148) – A; *I. manasei* (Cameroon, Mount Tabenken, Gen. prep.: SAFI00150) – B; *I. crawshayi maureli* (Ethiopia, Harar, Gen. prep.: SAFI00216) – C.

spine-like process on ventral edge, tapering to strongly inwardly curving tip. Fine serration present between ventral spine and tip. Fultura inferior circular, with lobe, which appears as triangle in lateral view. Aedeagus short, basal one-third bulbous, ventrally more sclerotized, dorsally membranous, broader middle section tapers down into terminal spine ventrally. On the membrane of vesica dorsally, short, upcurving spine (cornutus), on the tip of vesica a longer bent cornutus present.

Female facies (Figs 4A, D): Forewing length 16.8 mm, wingspan 32 mm. General appearance as for females of other species in the sub-genera *Argiolaus* and *Philiolaus* with black ground colour overlaid by blue, and orange spotting, sometimes fused into band along outer margin on hindwing in spaces 1a, 2 and 3. Underside dirty white with black and/or orange-red sub-marginal lines and two tails at the tip of veins 1 and 2 and a small kick at the tip of vein 3 on hindwing. Blue colour of dusky dark blue tone with darker silvery blue in outer half. Less than half of forewing covered with blue basally, costa broadly black to base. Outer edge of blue area evenly rounded. Basal half of hindwing covered with blue, between vein 1 and 5, with only a few scattered blue scales appearing in space 6. Rest of costal area dark grey. Black sub-marginal line formed

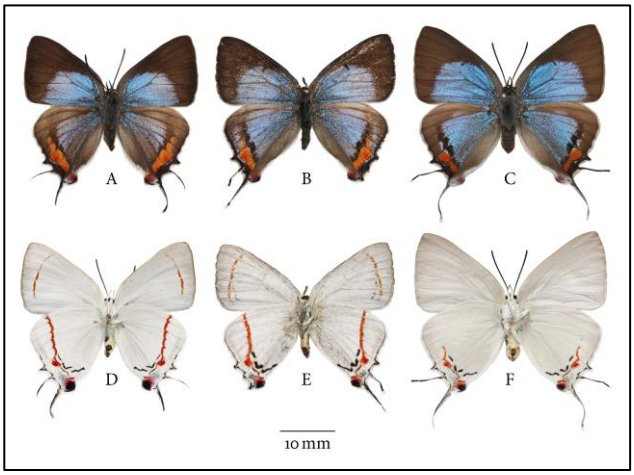

Figure 4 – Female adults: *I. gatamaiyu* (paratype) upperside – A, underside – D; *I. manasei* (Cameroon, Mount Tabenken) upperside – B, underside – E and *I. crawshayi maureli* (Ethiopia, Harar) upperside – C, underside – F.

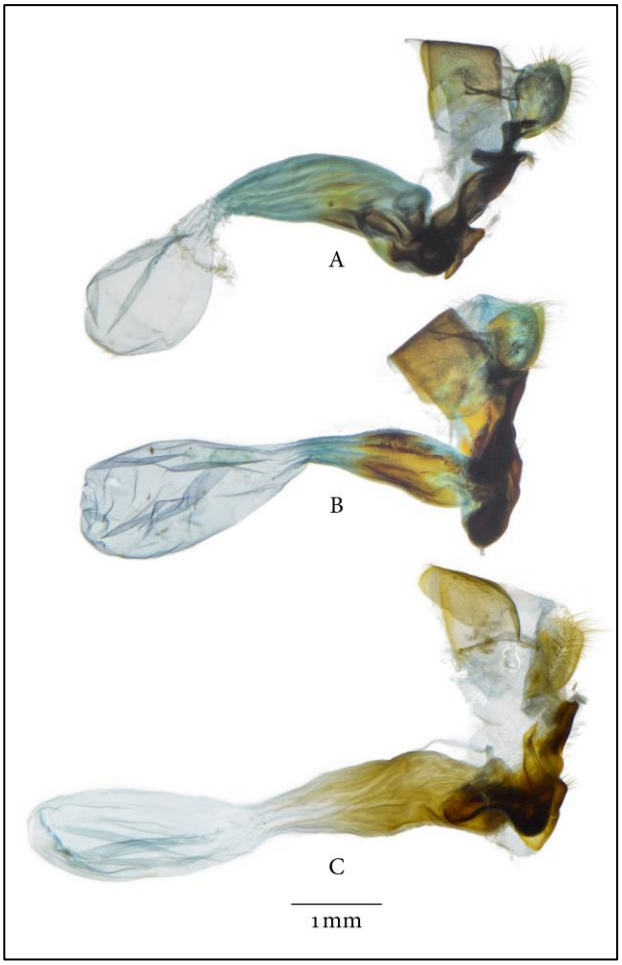

Figure 5 – Female genitalia (lateral view). *Iolaus gatamaiyu* (paratype, Gen. prep.: SAFI00149) – A; *I. manasei* (Cameroon, Mount Tabenken, Gen. prep.: SAFI00151) – B; *I. crawshayi maureli* (Ethiopia, Harar, Gen. prep.: SAFI00218) – C.

by prominent but narrow lunules in spaces 1, 2, 3 and 4. Tornal lobe claret red, edged with black line, not conjoined with the bright orange spotting in spaces 1-4 that fuses into an orange band. Tails black, edged with white. Underside colour and pattern and body identical to those of male.

Female genitalia (Figs 5A; 6A): Papillae anales oval in lateral view with rather sharp posterior edge, sharply

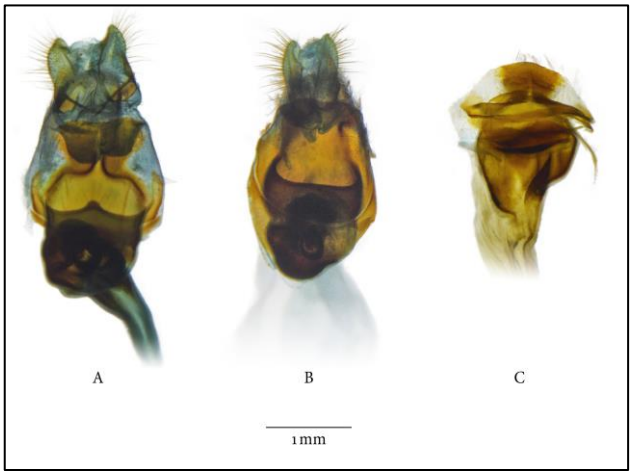

Figure 6 – Female genitalia (papillae anales, lamellae post and antevaginalis ventral view). *Iolaus gatamaiyu* (paratype, Gen. prep.: SAFI00149) – A; *I. manasei* (Cameroon, Mount Tabenken, Gen. prep.: SAFI00151) – B; *I. crawshayi maureli* lamella only (Ethiopia, Harar, Gen. prep.: SAFI00218) – C.

angled on dorsal edge. Apophyses posterior straight, their length is as papillae anales dorsoventrally. Lamella post and antevaginalis strongly sclerotized, long and complex with narrow "neck" below papillae, broadening at right angles both dorsally and ventrally. Ventral tip of plate with unusual hair-tuft. Plate is shield-like in ventral view with small protrusion in middle of posterior edge. Antrum of ductus very broad, sclerotized only at the mouth ventrally. Ductus broader than dorsoventral length of papillae, creased longitudinally, narrowing down only at the mouth of bursa copulatrix. Bursa globular, membranous, its diameter twice as long as dorsoventral length of papillae.

DIAGNOSIS

In general appearance, both the male and female of *I. gatamaiyu* sp. n. are very similar to those of *I. manasei*, but the blue on the forewing is less extensive in *I. gatamaiyu* sp. n., just crossing the fork of veins 3 and 4 (Figs 1A, D, B, E; 4A, D, B, E). The blue area extends beyond one-third of the length of vein 3 in both sexes of *I. manasei*. It is worth mentioning that the lack of a small black incision along the cell-closing vein on the forewing of both sexes could also prove diagnostic to *I. gatamaiyu*, as these appear in both *I. manasei* and *I. crawshayi maureli* (Figs 1B,C; 4B,C), but examination of further material of the latter two species would be needed to establish consistency of this feature. Presently, the surest way of separating *I. gatamaiyu* sp. n. from *I. manasei* is to view the male genitalia, as the subunci are rudimentary in *I. gatamaiyu* sp. n. (Fig. 2A), while a small straight process with blunt tip is present in *I. manasei* (similar to those in *I. silas*) (Fig. 2B). The valvae are also very different, triangular (in lateral view) in *I. gatamaiyu* sp. n. with a triangular spine-like process posteriorly (Fig. 2A), and the tip strongly bent inwards (Figs 2A; 3A). The valvae in *I. manasei* (as for those in *I. silarus*) are narrower and oval, with strongly oblong fish-tail like tip (Fig. 2B). The male genitalia of *I. gatamaiyu* sp. n. are more similar to those of *I. crawshayi crawshayi*, *I. crawshayi littoralis* (genitalia illustrated in Stempffer & Bennett 1958) and particularly to those of the Ethiopian *I. crawshayi maureli* (Figs 2C, F; 3C), but these taxa lack the sub-marginal red line on the forewing underside (Figs 1F; 4F). The female genitalia

resemble those of *I. silas* (not illustrated), but this species has its ductus bursae completely sclerotised to the mouth of the bursa copulatrix (identically to Libert's (1993) illustration, but this is contradictory to Henning & Henning (1984), who state that the ductus of *I. silas* is not well sclerotized). Both *I. manasei* and *I. crawshayi maureli* have their ductus more strongly sclerotised (Figs 5B, C) compared to those of *I. gatamaiyu* sp. nov. (Fig. 5A).

Biology: Several specimens of *I. gatamaiyu* sp. nov. were bred on a species of *Englerina* (Loranthaceae). *Erianthemum dregei* (Eckl. & Zeyh.) Tiegh. (Loranthaceae) was also mentioned as a host plant of the species in Congdon & Bampton (2000) under the name *Argiolaus* sp. (Gatamayo).

Etymology: The new species carries the name of Gatamaiyu Forest (spelt also as Gatamayu, Katamayu, Gatamayo), the southernmost forest area of the Aberdare Mountains in the Central Highlands of Kenya.

DISCUSSION

The male genitalia of *I. gatamaiyu* sp. nov. are closest to those of *I. crawshayi* (Butler, 1901), which itself needs further revision as multiple taxa (described as subspecies by Stempffer & Bennett, 1958) deserve specific status and further undescribed taxa in the group are also present (Sáfián & Collins unpublished). However, the presence of the red sub-marginal line on the forewing underside of *I. gatamaiyu* sp. nov. sets it apart from all recognized subspecies of *I. crawshayi* and molecular studies are needed for the correct placement of the species within the subgenus. The multiple known subspecies of *I. crawshayi* all seem to inhabit drier habitats, from coastal forest and woodland to dense savannah, but some occur in mountainous areas such as *I. crawshayi elgonae* with very different genitalic morphology and *I. crawshayi maureli* with more similar genitalic features. *I. gatamaiyu* sp. nov. appears to be an essentially montane forest species, known only from the Aberdare Mountains in the Central Highlands of Kenya. This is analagous to its presumed close relative, *I. manasei*, known only from the Cameroonian side of the Gulf of Guinea Highlands (Nigeria-Cameroon Highlands) (Fig. 7, p. 47).

Gatamaiyu Forest, the type locality of *I. gatamaiyu* sp. nov., harbours a rich montane butterfly fauna with endemic or restricted range taxa such as *Papilio jacksoni jacksoni* Sharpe, 1891, *Papilio dardanus polytrophus* Rothschild & Jordan, 1903, *Chondrolepis telisignata* ssp., *Charaxes acuminatus oreas* Talbot, 1932, *Charaxes ansorgei jacksoni* Poulton, 1933, *Charaxes nandina* Rothschild & Jordan, 1901, *Issoria hanningtoni jeanneli* (Bernardi, 1968), *Iolaus arborifera* Butler, 1901, (Larsen 1991, Larsen unpublished 2015, Williams 2022).

The majority of forests east of the Great Rift Valley have already disappeared due to deforestation and expansion of agriculture, and therefore the continued protection of Gatamaiyu Forest is necessary to conserve the butterfly fauna of Kenya's Central Highlands.

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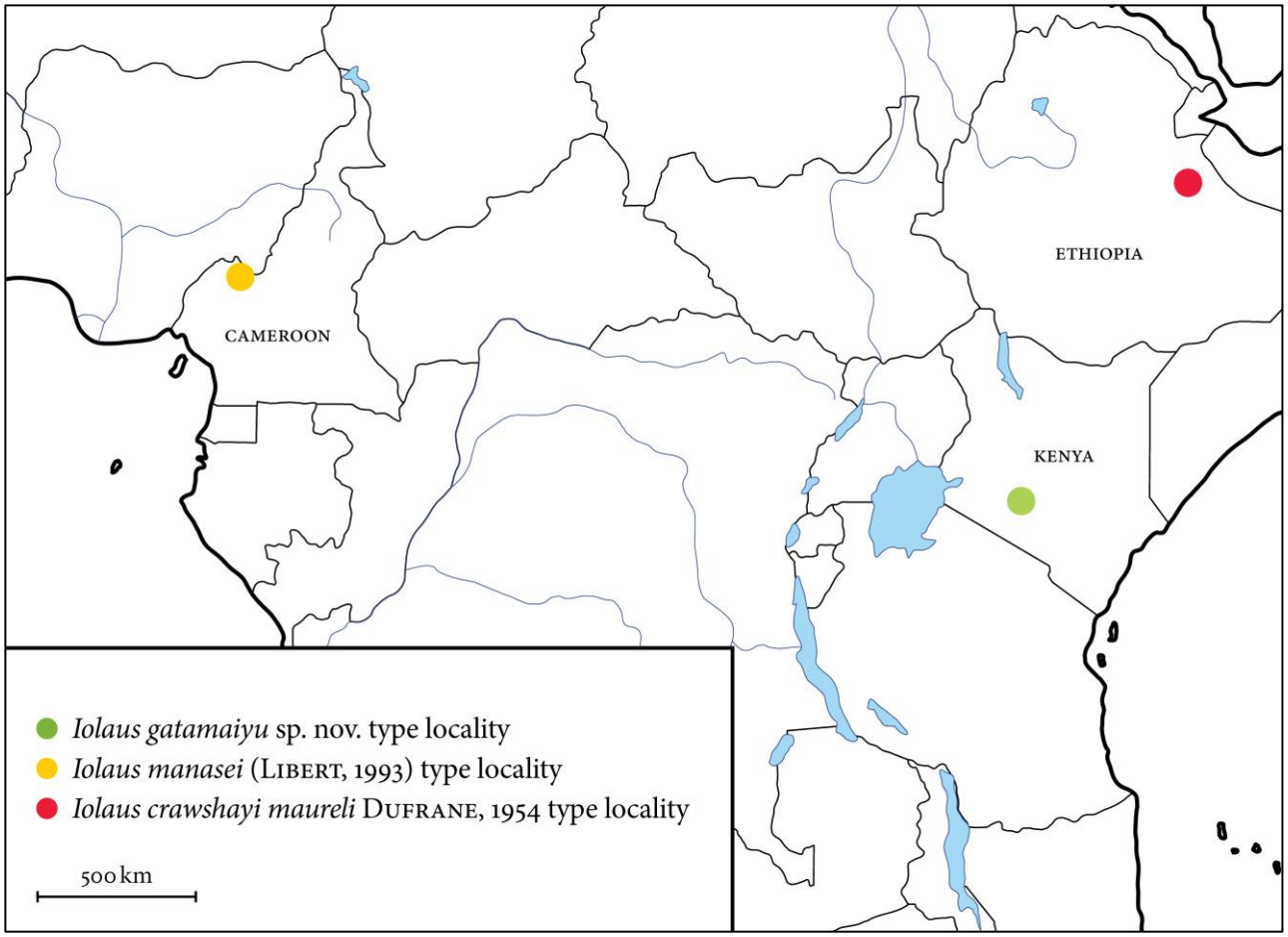

Figure 7 – Type localities of *I. gatamaiyu* sp. nov. and other *Iolaus* species appearing in the comparison.