

BICYCLUS BRAKEFIELDI (NYMPHALIDAE, SATYRINAE), A NEW SPECIES OF *BICYCLUS* FROM THE CONGO RIVER BASIN

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Abstract - A new species of *Bicyclus* is described from the Democratic Republic of Congo. The species belongs to the *ignobilis* species-group, but has different androconial structure and slightly different wing pattern. Genitalia differences are very small as is expected within most *Bicyclus* species-groups. Comparison with the other known species in the *ignobilis*-group and discussion of biogeography of the different species are provided.

Key words: *Bicyclus*, androconia, genitalia, morphology

Bicyclus Kirby, 1871 (Bush Browns) is the largest genus of African mainland Satyrinae (Nymphalidae). It presently has around 90 described species, and several subspecies. It was thoroughly revised by Condamin (1973), and his main species-groups have remained solid with just minor reorganisation after a species-level molecular phylogeny was made by Monteiro & Pierce (2001), even though relationships between the groups were substantially revised. In the latter study some species-groups (including the *ignobilis*-group) were only represented by a single species, but given that male genitalia structure is typically highly similar within each group and usually different among groups, the hypothesized species groups seem likely to be reliable.

Males of most *Bicyclus* species can be identified (and are often diagnosed in original descriptions) on the basis of the androconial structures (hairbrushes and patches of specialised scales) that are present in all species. Often, closely related species have different arrangements of these androconia, making identification fairly easy. Females can sometimes be hard to identify without access to several specimens and knowledge of male specimens from the same locality. The marked seasonal variation shown by most species makes identification of single females even more problematic. Many old descriptions of species were based on extreme seasonal forms of already described species, but this issue has been well resolved by Condamin (1973). Although male genitalia often have limited diagnostic power among closely related species, between the established species-groups genitalia can assist in indentifying similar-looking species.

The *ignobilis*-group is a small species-group with three previously known species. *Bicyclus ignobilis* (Butler, 1870) has a wide range across the African Guineo-Congolian forest zone, while the other two members, *B. maesseni* Condamin, 1971, and *B. rileyi* Condamin, 1961, are more range-restricted. The group is separated from other *Bicyclus* by their similar genitalia morphology (valves are rather straight and, unlike many other species group, lack major distinctive features), a somewhat irregular line of eyespots on the hindwing underside and a generally similar morphology (see below), even if some traits are shared with other species and/or groups. DNA sequence data for multiple genes were recently obtained for multiple *Bicyclus* species, including all three species within the *ignobilis*-group, and confirm the close relationship of the latter species (Aduse-

Poku *et al.* unpublished).

All species of the *ignobilis*-group are rainforest specialists. Like most other *Bicyclus* the food plants are unknown, and repeated egg-laying trials using females of *B. ignobilis* in both laboratory settings and in cages placed in their natural habitats have failed to produce any eggs, even when females have been offered a wide range of host plants (Brattström unpublished). Most species known to feed on grasses will readily lay eggs on almost any plant (and even the cage walls) under such trial conditions, suggesting that if the species within the *ignobilis*-group are grass feeders they are unusual in that they only lay their eggs on the actual food plants. It is also possible that the larvae feed on plants from the families Marantaceae and Zingiberaceae that are known to be used by a few rainforest *Bicyclus* species-groups (Schultze 1920, Vuattoux 1994 & Brattström unpublished). Although sometimes seen in some numbers on the wing, numbers of specimens in collections of these three species is often low due to their tendency to ignore fruit-baited traps that are used for collecting *Bicyclus*.

All species within the *ignobilis*-group have a prominent hair pencil placed at the base of the dorsal surface of the hindwing discal cell (a trait shared with all *Bicyclus* species except *B. buea* and *B. similis*). In its resting position this brush covers a groove in the wing surface placed along the base of vein 7. This groove contains specialised elongated scales. In contrast to most other *Bicyclus*, the species in the *ignobilis*-group have no matching patch of specialised scales on the underside of the forewing along vein 1 placed so that it covers the above-mentioned hairpencil when the wings are held in their resting position.

Bicyclus ignobilis has an androconium along vein 1b on the hindwing upper side unique to this species. The wing vein is clearly swollen along about one third of its length and covered by specialised scales. A comb of stiff black hairs that extends inwards from space 1c covers this part of the vein.

Bicyclus maesseni has a more basally located swelling of vein 1b, shorter than in *B. ignobilis* and not covered by any hairs. There is also a patch of androconial scales placed basally on the forewing dorsal surface just above vein 1 (a few scales cross the vein into space 1a). No clear hairbrush covers this patch.

Bicyclus rileyi has a patch of scales on the forewing in a similar position as in *B. maesseni*, but it is larger and based



Fig 1: a) ♂ *Bicyclus brakefieldi* (Holotype) Orientale Province, Congo; b) ♀ *Bicyclus brakefieldi* (Paratype) Equateur Province, Congo (location of ♂ Paratype); c) ♂ *Bicyclus ignobilis* Nord-Kivu, Eastern Congo; d) ♀ *Bicyclus ignobilis* Equateur Province, Congo (location of ♂ *B. brakefieldi* Paratype) (Images of undersides are mirror imaged, all images at same scale, exposure and colour balance)

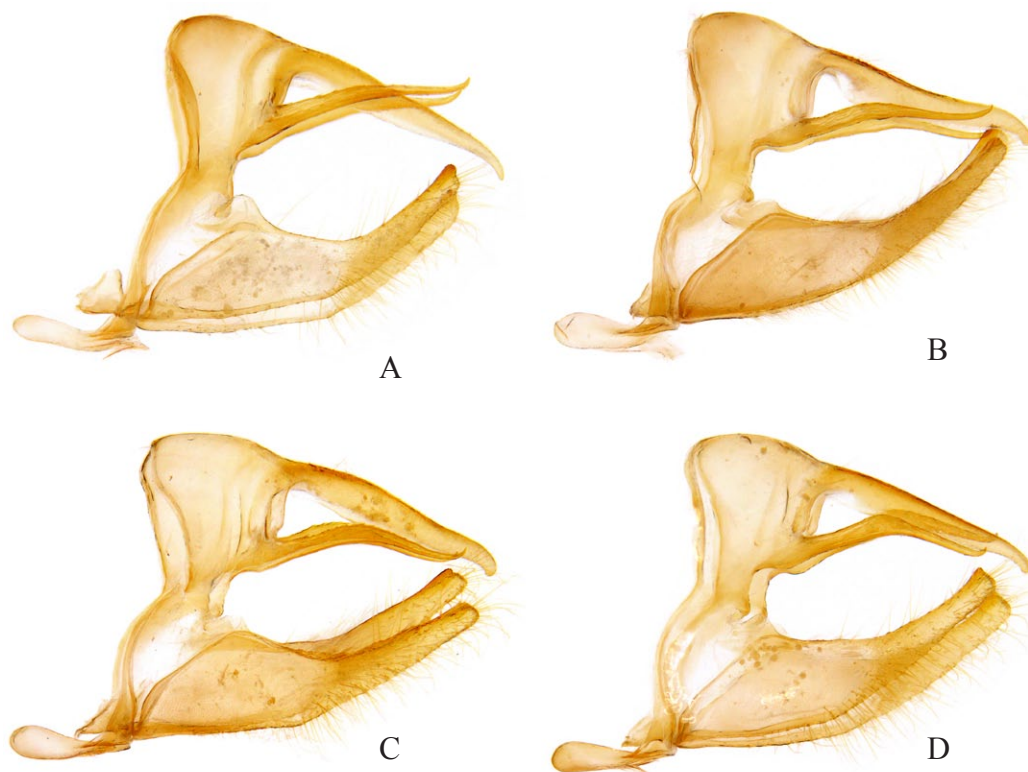


Fig 2: a) *Bicyclus brakefieldi*, Equateur Province, Congo (♂ Paratype); b) *Bicyclus maesseni*, Lipke, Ghana (Volta Region); c) *Bicyclus ignobilis*, Bitye, S Cameroon; d) *Bicyclus ignobilis*, Nord-Kivu, Congo (specimen pictured in Fig. 1c)

around vein 1 with a substantial amount of androconial scales in both space 1a and 1b. Furthermore, the patch is covered by a dense collection of hairs forming a brush-like structure missing in *B. maesseni*. Vein 1 is bent downwards towards the inner margin of the forewing at the middle of its length; in the other species vein 1 and 2 are running in parallel across their whole length. On the hindwing there are no swellings along vein 1b but the whole discal area in space 1a, 1b and 2 has a shinier surface and long black hairs are prominent in the whole discal area of these spaces, but not forming any brushes. *B. rileyi* is also a much larger species than the other member of the *ignobilis*-group.

METHODS

All of the available specimens within the *ignobilis*-group in the Musée Royal de l'Afrique Centrale (MRAC), Tervuren, Belgium were examined. Additional visits to the Natural History Museum, London, UK, Naturhistoriska riksmuseet, Stockholm, Sweden, and Zoologisches Museum, Humboldt Universität, Berlin, Germany, revealed no additional specimens. Furthermore, I asked colleagues that recently have been collecting in Africa if they had any atypical specimens from the *ignobilis*-group in their collections. The holotype male of *Bicyclus rileyi* was studied in London since the image available in Condamin's (1973) monograph was not accurate enough to identify the finer details of the androconia. The types of *B. ignobilis* and *B. maesseni* were not investigated. These are both well-known species, and the species-specific androconial structures make them easy to distinguish (Condamin, 1973).

Genitalia were dissected after having submerged the distal half of the abdomen in a hot 10% KOH solution for ten minutes. Genitalia were photographed (while submerged in 70% ethanol solution) using a LEICA M125 stereomicroscope coupled to a Leica DFC495 digital camera.

Bicyclus brakefieldi Brattström, sp. nov. (Figs 1a,b, 2a)

Holotype: ♂, Democratic Republic of Congo, Medje, Orientale Province, 750 m.a.s.l. (02°23'27" N 27°18'07" E), iv-vi.1910 (Exp. Lang-Chapin leg., MRAC) (Fig. 1a).

Paratypes: 1 ♂, Democratic Republic of Congo, Bamanya, Equateur Province, 300 m.a.s.l. (00°00'34" N 18°19'20" E), 28.ix.1961 (Rev. G. Hulstaert leg., MRAC); 1 ♀, Democratic Republic of Congo, Eala, Equateur Province, 300 m.a.s.l. (00°04'00" N 18°20'00" E), i.1936 (Lieut. J. Ghesquière leg., MRAC) (Fig. 1b); 1 ♀, Democratic Republic of Congo, Elisabetha, Orientale Province, 400 m.a.s.l. (01°09'00" N 23°35'13" E), no date (Mme Tinant leg., MRAC).

Description: Male forewing length 21 mm. Forewing upperside ground-colour is a dark, rather warm brown. The apical eyespot in space 5 of the forewing is well developed with an orange outer ring, but without a clear white pupil. The larger spot in space 2 is only vaguely showing through as a slightly darker shade than the ground colour. The apical patch covers much of spaces 5, 4 and 3, and is creamy-white in colour. The forewing has no androconia. The hindwing upperside has a pearly-white costal region ending at vein 6. The rest of the hindwing is darker brown than the forewing ground-colour and no eyespots are showing through from the underside. There is a pale yellow androconial brush extending from the basal part of the hindwing cell covering a groove of specialised scales along the base of vein 7. The hindwing has long hairs at the basal half of space 1c. Most of spaces 1b and 1a are covered in shiny black scales.

The underside ground colour is warm dark brown with pale purplish white streaks forming irregular bands along the whole wings, and also surrounding the eyespots that all possess white pupils. The forewing has a large eyespot

in space 2 and a smaller one in space 5. There are no well developed small satellite eyespots surrounding the spot in space 5. The hindwing has a row of eight eyespots from space 6 to space 1b (space 1c has two spots). The line of eyespots is quite regular but the spots in space 2 and 3 are displaced somewhat more basally. The spot in space 2 is enlarged while the spot in space 3 is very small.

Diagnosis: Male forewing length is similar to *B. ignobilis* and *B. maesseni*. The ground-colour is a bit warmer and lighter than the shinier blackish brown ground-colour found in *B. ignobilis* and *B. maesseni*. The forewing creamy-white apical spot is similar in size and shape to *B. rileyi*, but larger and less pure white than in *B. ignobilis* and *B. maesseni*. The underside has the typical pattern of the group, but the ground colour has less of a violet tinge than in *B. ignobilis* and *B. maesseni* with a generally warmer appearance. The spot in space 3 is present in both the male specimens, but it is somewhat reduced. The androconia are the clearest diagnostic feature setting this species apart from the rest of the *ignobilis*-group. The forewing has no trace of any androconium and vein 1 and 2 are parallel along their whole length. On the hindwing there is a yellow brush in the cell. There are no swellings along vein 1b, but the combination of long black hairs in space 1c, and shiny black scales in spaces 1a & 1b are similar to *B. rileyi*.

Male genitalia: The male genitalia are typical of the genus, and most likely of no diagnostic importance in the *ignobilis*-group as a whole. The genitalia of the male Paratype are pictured in Fig. 2 (compared with *B. ignobilis* and *B. maesseni*).

Discussion: The type specimens were found among *Bicyclus ignobilis* (under the name *Mycalasis ignobilis*) in the collection in the MRAC. The species at first looked like a small *B. rileyi*, but noticing the lack of forewing androconium and the venation pattern, it was clear that this was a distinct species. The paratype was found in the same drawer. I would guess the species is most closely related to *B. rileyi*, but as the specimens are too old for standard DNA barcoding, the exact relationship will have to wait until fresher material becomes available. In the same collection as the two known males are two females that stand out from the rest of the *B. ignobilis* females and I am fairly confident they are females of *B. brakefieldi*. One of the specimens (Fig. 1b) was collected within a few kilometres of the collection site for the male paratype and the other female was collected roughly in between the two sites for the males. Compared to females of *B. ignobilis*, they have a larger light apical patch. The spot in space 3 on the hindwing underside is present but smaller in one of the specimen (not figured). More specimens would be necessary to identify and comment on possible subtler distinctive characters. Given the patchy samples available from all over the region, it is hard to say

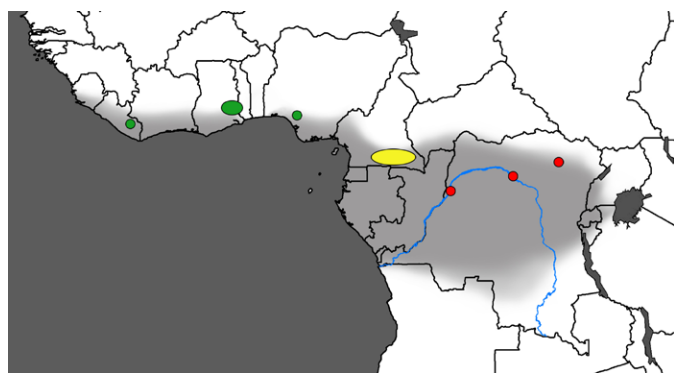


Fig 3: Map showing the known distribution of *Bicyclus ignobilis* (grey shade). The *Bicyclus brakefieldi* specimens were collected at the locations marked in red. Known locations for *Bicyclus maesseni* are marked in green and *Bicyclus rileyi* in yellow. The Congo River is marked in blue.

anything of the geographic distribution of *B. brakefieldi*. The two males were collected around 1000 kilometres apart, and from different sides of the River Congo (Fig. 3). It is likely that the species is rare but widespread in the whole Congo basin. *B. ignobilis* is definitely the most widespread member of the species-group while *B. maesseni* has a peculiar distribution, replacing *B. ignobilis* in the Volta region (but mainly occurs in the wetter parts of the area), yet both species occur sympatrically in some parts of Ghana (Atewa, Bobiri) (Larsen 2005, Larsen *et al.* 2007), Western Nigeria (Okumu) (Torben Larsen, personal communication) and also Liberia (Putu Range) (Szabolcs Sáfíán, personal communication). Since members of the species-group tend to be harder to collect than many other *Bicyclus*, and given that the sampling throughout the region tends to be patchy at best, exact distributions are very hard to estimate. For example, *B. rileyi* was previously known from a single pair collected in 1934 in Cameroon, and although it was described in 1961 it was not found again until 2000 when collectors from ABRI (Kenya) found the species (again in southern Cameroon, total of 30 specimens). It is quite probable that a few *B. brakefieldi* will be found hiding in major collections around the world. It seems possible that the species does not extend very far north of the equator; I have not seen any specimens during years of active search for *Bicyclus* in several West African locations.

Etymology: I name this species in honour of Professor Paul M. Brakefield who has spent (and still does spend) most of his research career studying various aspects of the genus *Bicyclus* and established *Bicyclus anynana* as a model system for evolutionary research.

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