The Chimarra of the georgensis and fallax species groups in Madagascar (Trichoptera, Philopotamidae)

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ABSTRACT

Chimarra zombitsei sp. nov. is described from Madagascar. It belongs to the georgensis species group, described by Blahnik et al. (2012) and recorded here for the first time from Madagascar. A preliminary list of the Afrotropical species belonging to the group is given. The fallax species group is newly described and a preliminary species list for the group is given. The male genitalia of the holotype of Chimarra dybowskina Navás, 1931 are described for the first time and the species distribution on Madagascar is briefly exposed. Chimarra lukawei Jacquemart, 1961 is reported for the first time from the country; its distribution is briefly exposed.

http://www.zoobank.org/urn:lsid:zoobank.org:pub:9004A4F3-9B7B-483D-8D41-04E92640E35C

Introduction

This work is an additional contribution to an inventory of the Malagasy caddisfly fauna. It deals with two species groups of Chimarra Stephens, 1829, that are widely distributed on the African continent and include, in the current state of the inventory, a small number of Malagasy species. The georgensis group was named for Chimarra georgensis Barnard, 1934; it was described by Blahnik et al. (2012) on the occasion of the discovery of the first Asiatic species in a group that was previously exclusively African. It is recorded for the first time from Madagascar, where it is represented by one species, endemic and new to science. The fallax group is described in this paper; it includes a dozen of closely related and, sometimes, insufficiently described Afrotropical species. Two species are known from Madagascar. Chimarra dybowskina Navás, 1931, was previously recorded from Madagascar by Gibon and Elouard (1996). Recently, Malicky (2015) recorded its presence on Nosy Be, a small island located at eight kilometres from the northwest coast, and gave figures of the male genitalia. Chimarra lukawei Jacquemart,
is reported for the first time from Madagascar under this name. A map of its distribution on the island was published by Gibon and Elouard (1996) under the name *Chimarra* sp. A; it is updated. Wings and male genitalia are described and figured.

**Material and methods**

The material was collected during the project ‘Biodiversité et Biotypologie des eaux continentales malgaches’ jointly conducted by the ORSTOM and the CNRE (Elouard and Gibon 2001). Specimens were captured using a portable light trap associating a black light and a gas lamp, then preserved in ethanol (75%). Male genitalia were cleared in a solution of potassium hydroxide, studied under the microscope in cedar oil, then mounted on slides in Euparal®. The type material is deposited in the CBGP (Campus international de Baillarguet, CS 30016, 34988 Montferrier sur Lez cedex, France). The terminology used hereafter is that of Blahnik (1998). As in previously published works (Gibon 2015), a restrictive species group concept, aggregating species offering a high concordance of male genital structure, was used. In too many cases, the published information does not permit the assignation of a species to a particular species group. Type material is not always available and a review of the African fauna is far beyond the objectives of this work. That is why the list of the species groups is preliminary, many species remaining *incertae sedis*. Schematic ecological profiles of the capture sites were established according to altitude, distance to the source and watershed; their construction, use and limitations were described and discussed by Randriamasimanana and Gibon (2001).

**Acronyms**

ORSTOM: Office de la recherche scientifique et technique outre-mer (Paris, France)
CNRE: Centre national de recherches sur l’Environnement (Antananarivo, Madagascar)
CBGP: Centre de Biologie pour la Gestion des populations (Montferrier, France)

**Systematics**

Family: Philopotamidae Stephens, 1829
Subfamily: Chimarrinae Rambur, 1842
Genus: *Chimarra* Stephens, 1829
Subgenus: *Chimarra* Stephens, 1829
The **Chimarra georgensis group**

The *georgensis* group was defined by Blahnik et al. (2012) when they described the first Asiatic member of the group: *Chimarra corneola*, distinct from the African species by large distal projections of tergum IX dorsal margin. Since the creation of the genus *Chimarrhafra* Lestage, 1936 for *C. georgensis*, the status and perimeter of this lineage have varied. This history was reviewed by Blahnik et al. (2012), who finally considered it ‘a distinct species group with plesiomorphic characters that would place it at or near the base of the *Chimarra* (*Chimarra*) lineage’. This statement is consistent with the opinion of Ross (1956), who considered a closely related species (*Chimarra hoogstraali* Ross, 1956) very close to the Asiatic ancestor of the Old World *Chimarra* (*Chimarra*). The plesiomorphic characters are:

1. weakly modified Rs and aligned crossveins (*s, r-m and m*) in the forewing,
2. narrow sternite IX, not ventrally protruding into the eighth. Other characters are apomorphic but may also be present in other species groups: the fusion of R1 and Sc in the hind wing at mid-length, the reduction of the number of sensilla of the tenth segment and the short and ventrally deflected phallotheca.

**Preliminary list of the African species of the georgensis group**

*Chimarra furcata* Jacquemart, 1961. Democratic Republic of Congo.

*Chimarra georgensis* Barnard, 1934. South Africa.

*Chimarra hoogstraali* Ross, 1956. Sudan.

*Chimarra kabashana* (Marlier), 1943. Democratic Republic of Congo.

*Chimarra zombitsei* sp. nov. Madagascar.

**Chimarra zombitsei** sp. nov.

Figs. 1A, 2A–F

*Chimarra* sp. A. Gibon & Elouard 1996

**Type material**

*Holotype* m: MADAGASCAR, Tsiribihina watershed, small brook near Tambaro, 20°25′40″S, 45°43′10″E, 187 m, 25.v.1996, desarticulated and mounted on four slides.

*Paratypes*: one male: same data, in ethanol, genitalia on one slide; four males, same data, in ethanol.

**Other examined material**

One male from the following sites (by watershed). BETSIBOKA: – small tributary of the Mamokomita near Mahatsinjo, 17°46′30″S, 47°00′52″E, 950 m,
01.xii.1994. EFAHO: – Ambahibe River near Isaka-Ivondro, 24°47′03″S, 46°51′46″E, 50 m, 16.v.1994. FIHERENANA: – Antsolo River, near Beba-Manamboay, 22°49′38″S, 44°36′28″E, 480 m, 20.iv.1993. MANAMPANIHY: – small tributary of the Manampanihy River, near Fenoevo, 24°41′00″S, 46°53′39″E, 72 m, 15.iv.1992. – Manampanihy River, near Manantenina (ferry), 24°16′08″S, 47°18′57″E, 2 m, 30.iv.1995. Mandrare: – Anadabolava River, near Mahaly, 24°13′18″S, 46°18′30″E, 209 m, 13.iv.1992. MANGOKY: – Malio River near Bereketa, 22°32′02″S, 45°08′28″E, 645 m, 19.iv.1994. – Italana River, near Bereketa, 22°34′53″S, 45°09′20″E, 800 m, 20.iv.1994. – Italana River near Bereketa, 22°34′02″S, 45°09′11″E, 745 m, 21.iv.1994. – Menamaty River near Ranohira,
Figure 2A–F. Male genitalia of *Chimarra zombitsei* sp. nov.; A, abdominal segments IX and X, caudal view; B, abdominal segments IX and X, dorsal view; C, inferior appendage, dorsal view; D, apex of the phallic apparatus, dorsal view; E, phallic apparatus, lateral view; F, genitalia, caudal view. Scale bar – 0.25 mm.
24°56’43”S, 46°58’53”E, 12 m, 04.ii.1996. Coastal marsh in the Tampolo Forest, near Fenoarivo, 17°16’37”S, 49°24’43”E, 19 m, 13.iv.1997.

**Diagnosis**

The African species of the *georgensis* species group are most easily distinguished from each other by the shape of the inferior appendages, elongate in *C. kabashana*, roughly triangular, with an extension of the dorsal edge in *C. hoogstraali* and *C. furcata*, rectangular with a small preapical extension of the ventral edge in *C. georgensis*, oval and elongated in *C. zombitsei* sp. nov. The two latter species are closely related; their distinction is confirmed by the shape of the phallic apparatus: the phallotheca of *C. zombitsy* sp. nov. is very short, ventrally almost reduced to a strongly curved beak, whereas in *C. georgensis*, the phallotheca is clearly longer (as viewed dorsally).

**Description**

Size: forewing length 4.7–4.9 mm, hind wing 3.7–3.9 mm. Colour (in alcohol) light brown. Fore wing: Rs weakly curved before discoidal cell, bases of R<sub>2+3</sub> and R<sub>4+5</sub> distinctly swollen. F1 and F2 present and sessile, F3 and F5 present and petiolate, F4 absent (M 3-branched); r present, s, r-m and m present, hyaline and linearly aligned, m-cu and cu present; 2A looped to 1A, 3A forked, anterior branch looped to 1A, posterior branch very short. Hind wing: Sc swollen, joining wing edge a little after mid-length, R1 fused to Sc before mid-length; F1, F2, F3 and F5 present; Cu2 slightly sinuous; 2A looped to 1A, 3A very small.

Male genitalia: Segment IX short, sternite slightly elongated ventro-distad, forming a small beak, in lateral view (but not a distinct ventral keel or sword), not produced or developed anteriorly into segment VIII. Tergum X dorsally membranous and fused with tergum IX; lateral lobes strongly sclerotised, basal part hidden in segment IX, distally extended in two branches (one dorsal, one ventral). Dorsal branch composed of a small protuberance bearing spicules and a short spear curved dorsad. Ventral branch, much longer, strongly curved, directed ventrad then distad, bearing basally a smaller spine. Preanal appendages short, bulbous with small setae. Inferior appendages simple, oval in lateral view; when viewed dorsally, slightly arched with an almost straight distal edge and a small bump on the inner face. Phallotheca short, distally lengthened by a ventral beak clearly bifid in dorsal view. Endotheca with a long and thin needle-shaped sclerite; phallosomal sclerite composed of two hook-shaped lateral parts and a central spine-shaped part.
**Etymology**

Named for the Zombitse Forest, where the species was collected. This forest is now included in the Zombitse Vohibasia National Park.

**Distribution**

Endemic to Madagascar.

**The Chimarra fallax group**

The *Chimarra fallax group* is related to the *Chimarra minima* group (Gibon 2015). In both groups, 1/ tergum IX is membranous (when viewed caudally, the ninth segment is not ring-shaped but U-shaped or horseshoe-shaped (Figure 3D), 2/ the tergum X is reduced to the lateral lobes, 3/ the lateral lobes of tergum X are widely separated and divided into two secondary lobes (one latero-dorsal and one latero-ventral). They differ by the structure of the phallotheca, whose apex is laterally extented in the *minima* group, as opposed to being ventrally extended in the *fallax* group. Furthermore, the particular structure of the inferior appendages (with their distal and inner strongly sclerotised lobes) is apomorphic in the *minima* group. The long ventral sword-shaped keel of sternite IX, present in all species of the *fallax* group, is absent in the *minima* group.

**Preliminary list of the fallax group**

*Chimarra bettinae* Marlier & Marlier, 1982. La Réunion.

*Chimarra caboverdensis* Nybom, 1960. Cabo Verde.

*Chimarra calundoensis* Marlier, 1965. Angola.

*Chimarra divergena* Gibbs, 1973. Ghana.

*Chimarra dybowskina* Navás, 1931. Congo, Ivory Coast n. cit., Burkina Faso, Guinea n. cit., Mali n. cit., Togo n. cit., Cameroon n. cit., Madagascar.

*Chimarra elga* Mosely, 1939. Kenya.

*Chimarra falcifera* Jacquemart, 1966. Democratic Republic of Congo.

*Chimarra fallax* Ulmer, 1912. Cameroon, São Tomé.

*Chimarra lukawei* Jacquemart, 1961. Democratic Republic of Congo, Ghana, Madagascar n. cit.

*Chimarra mauritania* Jacquemart, 1960. Mauritius.

*Chimarra robynsi* (Jacquemart, 1966). Democratic Republic of Congo.

*Chimarra travei* Jacquemart, 1963. Mauritius.
Some species of the group have been included in two recently published phylogenetic studies and analysed by Bayesian analysis (Kjer et al. 2014; Wahlberg and Johanson 2014). Generally speaking, these analyses confirm the polyphyly of the subgenus Chimarra in Africa and in Madagascar, most of the lineages being shared with Asia, Australasia or South America. Considering the fallax species group: *C. caboverdensis*, *C. elga* and an unidentified species from Kivu are associated and isolated from the other species of the subgenus in a COI-based cladogram (Kjer et al. 2014). In a tree based on three coding genes (COI, CAD and POL-II, Wahlberg and Johanson 2014), *C. lukawei* (from Ghana), *C. calundoensis* (from Madagascar) and an undetermined Malagasy species are associated in a small

**Figure 3A–D.** Male genitalia of A, Chimarra dybowskina, holotype, lateral view; B–D, Chimarra lukawei, B, abdominal segments IX and X, lateral view; C, phallic apparatus, lateral view; D, abdominal segments IX and X, caudal view. Scale bars – 0.25 mm.

**Phylogenetic placement of the group**

Some species of the group have been included in two recently published phylogenetic studies and analysed by Bayesian analysis (Kjer et al. 2014; Wahlberg and Johanson 2014). Generally speaking, these analyses confirm the polyphyly of the subgenus Chimarra in Africa and in Madagascar, most of the lineages being shared with Asia, Australasia or South America. Considering the fallax species group: *C. caboverdensis*, *C. elga* and an unidentified species from Kivu are associated and isolated from the other species of the subgenus in a COI-based cladogram (Kjer et al. 2014). In a tree based on three coding genes (COI, CAD and POL-II, Wahlberg and Johanson 2014), *C. lukawei* (from Ghana), *C. calundoensis* (from Madagascar) and an undetermined Malagasy species are associated in a small
group, whose nearest relative is a group including *C. chichewa*, Wahlberg et al. 2014, *C. circumverta*, Wahlberg et al. 2014 (both from Malawi) and an undetermined South African species. Both groups are themselves related to a group of Melanesian species. These results are consistent with the phylogenetic coherence of the species assigned to the *fallax* group.

**Chimarra dybowskina Navás, 1931**

Fig. 3A

*Chimarrha dybowskina* Navás, 1931. Original description

*Chimarra dybowskina*. Presence in Madagascar, Gibon & Elouard 1996.

*Chimarra dybowskina*. Description of male genitalia, presence on Nosy Be (off the Malagasy western coast), Malicky 2015.

I have examined the holotype of this species, deposited in the MNHN (Paris). The type-locality is « Congo », which may designate two countries or a river. Dybowski was a French explorer who travelled from the Ubangi River to the Logone River. Without certainty, we may assume that the type river is the Ubangi, on the boundary between the Republic of Congo and the Democratic Republic of Congo. The genitalia (Fig. 3A) are identical to those of a specimen from the Sanaga River deposited at the Museum für Naturkunde (Berlin, labelled: Kamerun, Edea, 14 I, Dr. Guillemain); they exhibit minimal morphological differences with those collected in Togo, Ivory Coast, Guinea, Burkina Faso and Mali during the freshwaters monitoring implemented by the Onchocerciasis Control Program (Resh et al. 2005), and, more unexpectedly, with Malagasy specimens (Gibon and Elouard 1996). Recently, Malicky (2015) reported this species from Nosy Be and gave illustrations of the genitalia. Morphological differences between *C. dybowskina*, *C. divergena*, *C. calundoensis* and *C. caboverdensis* are not clear, because detailed information on *C. dybowskina* was not available at the time of their descriptions. The status of these species should be clarified.

**Malagasy records** (by watershed). BETSIBOKA – Ikopa near Fiadanana, 18°10′03″S, 46°56′58″E, 975 m, 18.iv.1991 – Small tributary, near Ambalambongo, 16°48′00″S, 47°00′30″E, 48 m, 30.iii.1993 – Small tributary, 53 km from Maevatanana, 16°42′13″S, 47°04′33″E, 49 m, 02.iv.1993 – Small tributary, 5 km from Mahatsinho, 17°46′30″S, 47°00′52″E, 950 m, 01.xi.1994. TSIRIBIHINA – Small tributary, 19°42′05″S, 46°37′00″E, 1075 m, 14.v.1996 – 19°36′10″S, 46°01′50″E, 820 m, 19.v.1996 – near Tambaro, 20°25′40″S, 45°43′10″E, 187 m, 25.v.1996 – Poamay near Poamay, 20°25′30″S, 45°25′45″E, 200 m, 30.v.1996 – Small affluent of the Manandona, near Antsirabe, 19°56′52″S, 47°02′29″E, 1420 m, 18.iv.1995. MANGOKY – Italana near Bereketa, 22°34′28″S, 45°09′18″E, 760 m, 22°34′02″S, 45°09′11″E, 745 m, & 22°34′53″S, 45°09′20″E, 800 m, 21.iv.1994 – Menamaty near Ranohira, 22°33′33″S, 45°24′21″E, 800 m, 22.iv.1994 – Ambalamamy near Anjoma, 20°50′26″S, 47°07′43″E, 1400 m, 22.v.1995. ONILAHY – Ianakandrarezo near the ‘Piscine naturelle’, 22°33′03″S, 45°20′57″E, 850 m, 23.iv.1994 – Small
tributary, near the ‘Relais de la Reine’, 22°38’37"S, 45°19’25"E, 810 m, 01.vi.1995.
FIHERENANA – Near Voandelaka, 22°51’35"S, 44°35’03"E, 530 m, 19.iv.1993
– Antsolo near Beba-Manamboay, 22°49’38"S, 44°36’28"E, 480 m, 20.iv.1993.
MANDRARE – Andratina near Imanambo, 24°20’20"S, 45°57’32"E, 213 m, 12.iv.1992 – Imonty near Imonty, 24°48’51"S, 46°41’25"E, 175 m, 21.v.1994 – Esomony near Esomony, 24°30’53"S, 46°37’28"E, 475 m, 01.ii.1996 – Sakamalio near Andohahela, 24°32’07"S, 46°40’56"E, 750 m & 24°32’13"S, 46°40’49"E, 725 m, 02.ii.1996 – Sakamamba near Imanambo, 24°28’32"S, 45°45’59"E, 340 m, 09.vi.1994 – Sakamamba near Imanambo, 24°28’32"S, 45°45’59"E, 340 m, 20.iv.1995. EFAHO – Antsanira near Ranopiso ambany, 25°01’27"S, 46°39’30"E, 100 m, 25.v.1994 – near Ranopiso ambany, 25°02’13"S, 46°40’23"E, 45 m, 15.v.1994 – Ambahibe near Isaka – Ivondro, 24°47’03"S, 46°51’46"E, 50 m, 16.v.1994 – Small tributary, 24°46’38"S, 46°52’11"E, 120 m, 20.xi.1995 – Ambahibe near Isaka – Ivondro, 24°46’47"S, 46°51’53"E, 70 m, 20.xi.1995. MANAMPANIHY – Small tributary of the Manampanihy, near Fenoevo, 24°41’00"S, 46°53’39"E, 72 m, 15.iv.1992 – Andranohela near Bevoay, 24°40’00"S, 46°49’25"E, 98 m, 29.xi.1995. SAHANKAZO – Antsandrangotika River, 12°28’40"S, 49°23’46"E, 50 m, 04.iv.1994 – Antsahamaiky, 21 km from Joffreville, 12°30’03"S, 49°24’52"E, 75 m, 28.iii.1995. SAHARENANA – Andranomena near Analandrainiboto, 12°36’16"S, 49°22’25"E, 175 m, 28.iii.1995 – Saharenana near Ambahivahibe, 12°34’44"S, 49°16’38"E, 422 m, 30.iii.1995. IRODO – Antsakoabe near Antsakoakely, 12°39’00"S, 49°15’00"E, 520 m, 30.iii.1995. IVONDRO – Manambolo near Ampasimadinika, 18°24’53"S, 49°09’51"E, 44 m, 17.i.1996. MANGORO – Mangoro near Mangoro (main bridge, road to Toamasina), 18°52’32"S, 48°06’32"E, 840 m, 13.v.1991 & 06.v.1994 – Ilazana near Ambodiavozovelo, 18°58’54"S, 48°36’41"E, 430 m, 18.i.1996 & 24.iv.1997 – Beforona near Marovoalavo, 18°57’46"S, 48°33’36"E, 550 m, 25.iv.1997 – Sandrakatrina near Ambodiaviavy, 18°57’31"S, 48°39’45"E, 350 m, 26.iv.1997. NAMORONA – Small tributary, 21°16’35"S, 47°31’03"E, 580 m, 22.iv.1992 – Namorona near Ranomafana, 21°15’37"S, 47°27’18"E, 725 m, 16.iv.1994 – Namorona near Ranomafana, 21°15’30"S, 47°27’09"E & 21°15’20"S, 47°27’05"E, 725 m, 16.iv.1994 – Tamara, 4 km upstream of Ranomafana, 21°14’45"S, 47°25’37"E, 850 m, 17.iv.1994 – Ambatandrano near Ambatandranaro, 21°14’45"S, 47°26’32"E, 775 m, 17.iv.1994 – Sahavatoina near Ambohimisafy, 21°25’07"S, 47°36’00"E, 480 m, 22.iv.1994 – Small tributary, 21°35’25"S, 47°58’21"E, 40 m & 21°35’38"S, 47°59’09"E, 35 m, 23.iv.1994. MANANJARY – Fotobohitra, 1 km upstream of Kianjavato, 21°22’36"S, 47°51’38"E, 75 m, 03.xii.1995 & 25.v.1995. Small coastal watersheds, eastern coast – Tampolo Forest, 17°16’37"S, 49°24’43"E, 19 m, 13.iv.1997 – Small brook near Ramena, 17°27’40"S, 49°23’07"E, 50 m, 14.iv.1997 – Sainte-Marie Island, Small brook near Ste Marie Lonkintsy, 16°53’03"S, 49°53’03"E, 2 m, 01.iii.1997.
**Chimarra lukawei** Jacquemart, 1961

Figs. 1B, 3B–D
*Chimarra* sp. AK. Gibon & Elouard 1996

The genitalia are figured (Fig. 3B–D) for a better understanding of their structure; in particular, the tergum IX and the dorsal part of tergum X are fused into a thin membrane and the lateral parts of tergum X are composed of two distinct elements. These are characters of the whole group.

**Malagasy records**

One male from the following sites (by watershed). MANGORO: – Mangoro River near Mangoro (main bridge on the road to Toamasina), 18°52'32"S, 48°06'32"E, 840 m, 06.v.1994 – Mandraka River, 2 km downstream of Ambodinifody, 18°52'06"S, 48°03'12"E, 1060 m, 29.iv.1995. SAKANILA: – Vakoho, road to Lakato, 19°07'13"S, 48°23'57"E, 820 m, 20.iii.1995. RIANILA: – Sahatandra near Ambodirina, 19°01'32"S, 48°20'28"E, 980 m, 21.iii.1995. NAMORONA: – Namorona near Ranomafana, 21°35'38"S, 47°59'09"E, 35 m, 23.iv.1994 – Ambatandrano River near Ambatandrano, 21°14'45"S, 47°26'32"E, 775 m, 17.iv.1994 – Small tributary of the Namorona, 21°35'20"S, 47°07'21"E, 20 m, 25.iv.1994. BETSIBOKA: – Small tributary, 5 km from Mahatsinjo, 17°46'30"S, 47°00'52"E, 950 m, 01.xii.1994. MANGOKY: – Italana near Ranohira, 22°34'53"S, 45°09'20"E, 800 m, 20.iv.1994. ONILAHY: – Ianakandrarezo near the 'Piscine naturelle', 22°33'03"S, 45°20'57"E, 850 m, 23.iv.1994 – Small tributary, near the 'Relais de la Reine', 22°38'37"S, 45°19'25"E, 810 m, 01.vi.1995. MANDRARE: – Bezavo near Berohanga, 24°38'57"S, 46°36'07"E, 550 m, 06.vi.1994. EFAHO: – Small tributary, 24°46'38"S, 46°52'11"E, 120 m, 20.xi.1995 – Ambahibe near Isaka – Ivondro, 24°46'47"S, 46°51'53"E, 70 m, 20.xi.1995. MANAMPANIHY: – Small tributary of the Manampanihy near Fenoarivo, 24°41'00"S, 46°53'39"E, 72 m, 15.iv.1992 – Manampanihy near Manantenina (ferry), 24°16'08"S, 47°18'57"E, 2 m, 30.iv.1995. Coastal marshes in the Tampolo Forest, near Fenoevo, 17°17'07"S, 49°25'00"E, 10 m, 11.iv.1997 – 17°17'07"S, 49°25'40"E, 8 m, 12.iv.1997.

**Ecological data**

Ecological and geographic information on the *fallax* and *dybowskina* groups in Madagascar are summarised on Figures 4 and 5. The three species are widely distributed on the island. *C. zombitsei* n. sp. and *C. lukawei* are absent from the northernmost part of the island, while *C. dybowskina* was recorded from the piedmont of Amber Mountain. Nevertheless, some northern areas (Sambirano, Tsaratanana Mountain, Antongil) could not be included in the sampling. *C. zombitsei* sp. nov. and *C. lukawei* are present from sea level to 1.000 m; *C. dybowskina* was scarcely
observed above this limit on the Central Highlands. The three species are potentially present throughout the longitudinal gradient of river systems, but large western streams are unfavourable to filter-feeders because of their high sediment loads. They are absent from the humid forest, which is the exclusive habitat of Malagasy Rossodinæ Özdikmen & Darilmaz, 2008 and Philopotamænæ Stephens, 1829 (Gibon 2013, 2014). On the eastern slope, they are mainly located in the wide transition area between forest and open landscape created by the deforestation (Humbert 1927; Jarosz 1993). On the western slope, they are located in forest relicts (Zombitse and Vohibasia National Park), headwaters (Isalo National Park) or upstream of ricefields, on rivers protected by remnants of riparian vegetation (border of Central Highlands). In these areas, the hydrological conditions are less harsh than in the common streams of the western open landscapes colonised by C. vulgaris Gibon, 2015 and C. antsymeloka Gibon, 2015.

**Acknowledgements**

I thank Dr. Jean Legrand and Dr. Wolfram Mey for their welcome at, respectively, the Museum National d’Histoire Naturelle (Paris) and the Museum für Naturkunde (Berlin). I am also grateful to all those who participated in the project Biodiversité and Biotypologie des eaux continentales malgaches, to two anonymous rewriters and to R. Blahnik for valuable remarks on the African Chimarra.
Disclosure statement

No potential conflict of interest was reported by the author.

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