

## New *Helicopsyche* von Siebold, 1856 (Trichoptera : Helicopsychidae) from East Africa

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Keywords : Trichoptera, Helicopsychidae, *Helicopsyche*, systematics, new species, East Africa, Tanzania.

*Helicopsyche annae* sp.n., *H. barbata* sp.n., *H. bifida* sp.n., *H. jacquemarti* sp.n., *H. pedunculata* sp.n., *H. stoltzei* sp.n., *H. tanzanica* sp.n., *H. ulugurensis* sp.n. and *H. usambarensis* sp.n. (Trichoptera : Helicopsychidae) are described. All the new species inhabit mountainous areas in eastern Tanzania. *Helicopsyche marlieri* Jacquemart, 1957 from eastern Zaïre is redescribed. A key to the species known from East Africa is provided. Distributional and ecological data are discussed and briefly analyzed.

### Nouveaux *Helicopsyche* von Siebold, 1856 d'Afrique orientale (Trichoptera : Helicopsychidae)

Mots-clés : Trichoptera, Helicopsychidae, *Helicopsyche*, systématique, nouvelle espèce, Afrique orientale, Tanzanie.

*Helicopsyche annae* n.sp., *H. barbata* n.sp., *H. bifida* n.sp., *H. jacquemarti* n.sp., *H. stoltzei* n.sp., *H. tanzanica* n.sp., *H. ulugurensis* n.sp. et *H. usambarensis* n.sp. (Trichoptera : Helicopsychidae) sont décrits. Toutes ces espèces nouvelles colonisent des zones montagneuses de la Tanzania orientale. *H. marlieri* Jacquemart, 1957 de l'Est Zaïre est redécrite. Des données sur leur répartition et leur écologie sont discutées et brièvement analysées.

## 1. Introduction

The world fauna of *Helicopsyche* includes nearly 150 species, mostly restricted to the tropics (Malicky 1992, Schmid 1993, Williams et al. 1983). The larval cases are constructed of sand grains, clued together by silk and coiled dextrally. Nearly all species inhabit well aired, running waters, but *Helicopsyche borealis* (Hagen, 1861) is recorded also from the littoral zone of lakes (Vaughn 1985a, b). Only one species, *Helicopsyche marlieri* Jacquemart, 1957, was previously known from the African mainland. This species was described from male pupae from the Nyaleka and Malulu Rivers near Semliki, eastern Zaïre. In addition, larvae of *Helicopsyche* have repeatedly been recorded from East Africa (Marlier 1954a, Scott 1985a, b, Verdcourt 1952, 1953, 1955) and are also known from Ghana (J. Amakye pers. comm.). Undoubtedly, many more species will be

discovered from the African mainland in the future. Two species, *Helicopsyche palpalis* (Ulmer, 1910) and *Helicopsyche kantilali* Marlier & Malicky, 1979 are known from Mahé Isl., the Seychelles. *H. palpalis* was originally assigned to the *Petrotrichia*, within Hydroptilidae, by Ulmer (1910). *H. palpalis* and *H. kantilali* are discussed by Marlier & Malicky (1979). No *Helicopsyche* have so far been recorded from Madagascar (F.M. Gibon, pers. comm.).

## 2. Material and methods

The study of the African species of Helicopsychidae is based on specimens conducted by an expedition to West Usambara by staff and students from the Museum of Zoology, University of Bergen, during October-December 1990. The specimens were mainly taken in Malaise traps, and a few specimens were also caught by net and in light traps. A few larvae were sampled from the streams. All the material is deposited at Museum of Zoology, University of Bergen, Norway (ZMBN). Additional material was borrowed from the Museum of Zoology,

1. Museum of Zoology, University of Bergen, Muséplass 3, N-5007 Bergen, Norway.

University of Copenhagen, Danmark (ZMUC), and the Institut royal des Sciences Naturelles de Belgique (IRSNB). The material from ZMUC was caught by Mr. Stoltze and Mr. N. Scharff in East Usambara, Uzungwa and Uluguru Mts in 1980, 1981 and 1982, and by Mr. N. Scharff and Mrs. G. I. Petersen in Uzungwa Mts in 1984. All the specimens were taken by net and transferred into 70 % alcohol. The material also contained several larvae, but as for the larvae from West Usambara, none of these were possible to associate to species. All specimens of *H. marlieri* were sampled by G. F. de Witte in 1953 and 1956 from the northern parts of Albert National Park, E. Zaïre.

The holotypes, allotypes and a few paratypes of the new species, as well as all the material of *H. marlieri*, are mounted as microscope preparations in Canada balsam. The remaining material is in 70 % alcohol.

Terminology of wing venation and genitalia follows Mosely & Kimmins (1953), Nielsen (1957, 1980) and Ross (1975).

### 3. Characteristics of the East African *Helicopsyche*

#### Genus *Helicopsyche* von Siebold, 1856

Type: *Helicopsyche shuttleworthi* von Siebold, 1856, designated by Flint (1964): 69.

*Helicopsyche* from the African mainland have maxillary palps 2-segmented in males, 5-segmented in females. Both maxillary and labial palps are light brownish-white. Head brown with black and brownish-white setae. Antennae light brown. Thorax light brown with dark brown scutum; setal warths present on scutum and scutellum. Legs light brownish-yellow with darker setae on femur and tibia; spur formula 2,2,4. Wing setae pale brown, membrane uniformly light greyish-brown, densely covered with setae. Both males and females with forks 1 and 2 anterior wings and fork 1 in posterior wings. Anterior wings without corneus point; posterior wings without disc-cell; with well developed hamuli. Abdomen with large, light pleurites; setae on tergites and sternites arising from large, bright tubercles; sixth sternum with a pointed mesal process. Male genitalia with one pair of inferior appendages reduced, the present pair is strongly bifurcated into an upper and lower branch; the upper

branch terminally slender compared to distal part; lower branch smooth, sigmoid and distally directed mesad. Phallus large, with one or two pairs of sclerous appendages. Female genitalia with external part of gonopods VIII fused medially; Xth segment separated in dorsal Xa and ventral Xb, easily seen in lateral view.

### 4. Key to the males of *Helicopsyche* from East Africa

- 1 IXth segment with sclerotized process close to superior appendage (Figs 5 B, 10 D) ..... 2
- IXth segment without such sclerotized process (Fig. 1 B) ..... 3
- 2 Lower branch of inferior appendage strongly curved (Fig. 5 B); Xth tergum basally bifurcate (Fig. 5 B); phallus with wreath of microtrichia on posterior pairs of sclerous processes ..... *H. marlieri* Jacquemart, 1957
- Lower branch of inferior appendage slightly curved (Fig. 10 E); Xth tergum medially bifurcate (Fig. 10 D); phallus with wreath of microtrichia on anterior pairs of sclerous processes (Fig. 10 C) ..... *H. usambarensis* sp.n.
- 3 Xth tergum with phallus grip (Fig. 2 B); scape more than three times the length of the pedicel ..... 4
- Xth tergum without phallus (Fig. 4 B); scape less than three times the length of the pedicel ..... 5
- 4 Anterior wings longer than 6.0 mm; IXth sternite with dark, short and strong setae (Fig. 2 F) ..... *H. barbata* sp.n.
- Anterior wings about 4.2 mm; IXth sternite without dark, short and strong setae ..... *H. stoltzei* sp.n.
- 5 Xth tergite short, continuously stout in lateral view, distally bifurcate (Fig. 6 B); anterior apical spur on tibia 1 less than twice the length of the posterior apical spur ..... *H. pedunculata* sp.n.
- Xth tergite long and slender, medially bifurcated (e.g. Figs 3 B, 4 B & 9 B); anterior apical spur on tibia 1 always more than twice the length of the posterior apical spur ..... 6
- 6 Upper branch of inferior appendage shorter than lower branch (Fig. 4 B); superior appendage with distinct sclerous process directed ventrad (Fig. 4 F) ..... *H. jacquemarti* sp.n.
- Upper branch of inferior appendage longer than, or as long as lower branch (Figs 3 B, 8 B); superior appendage with no processes (Fig. 1 B) ..... 7
- 7 Lower branch of inferior appendage with dorsal directed process (Fig. 9 B); phallus with two pairs sclerous processes on peduncle (Fig. 9 F) ..... *H. ulugurensis* sp.n.

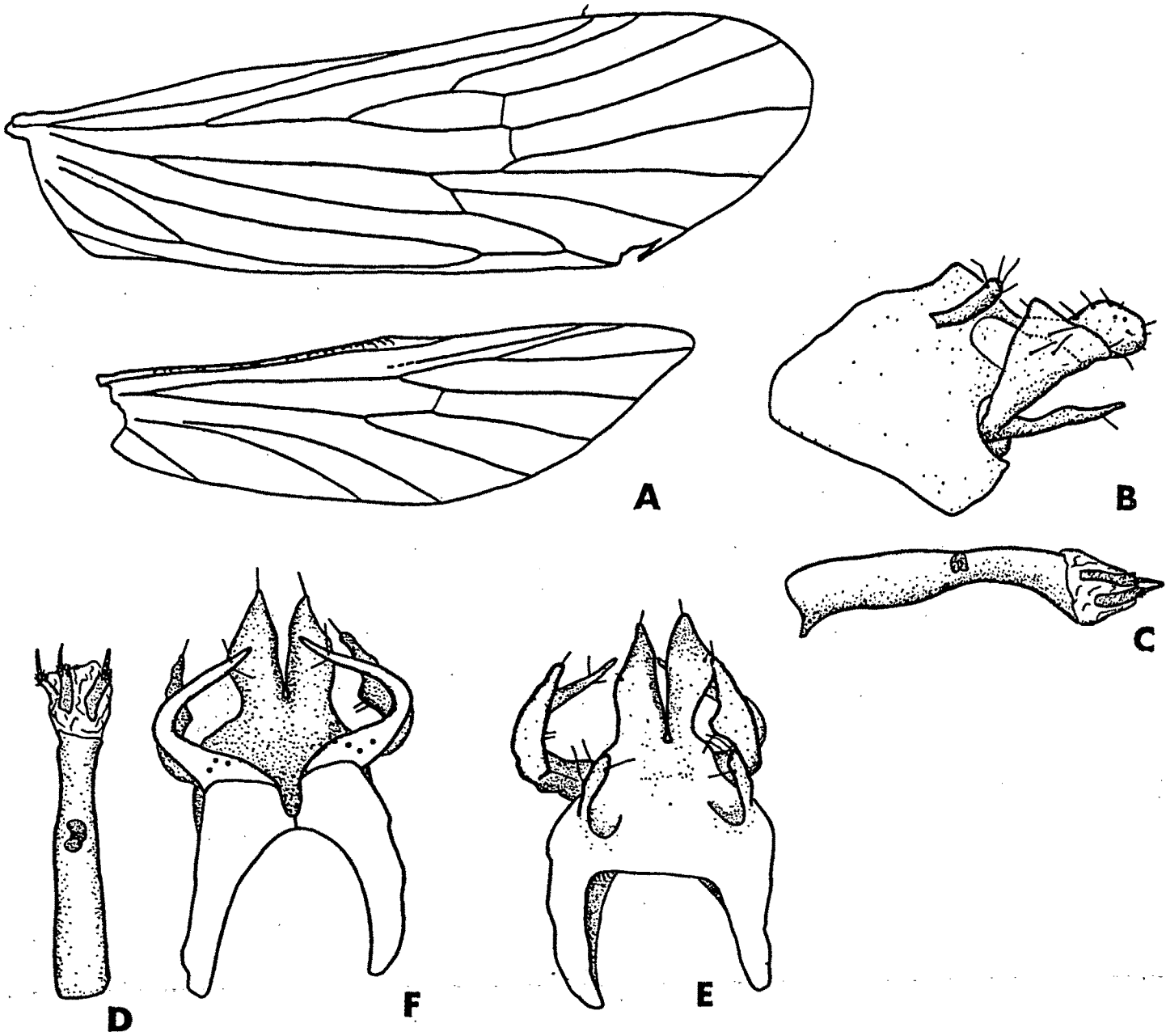


Fig. 1 (A-F) : *Helicopsyche annae* sp.n. ♂. A : anterior and posterior wings. B : genitalia, lateral view. C : phallus, lateral view. D : phallus, ventral view. E : genitalia, dorsal view. F : genitalia, ventral view.

Fig. 1. (A-F) : *Helicopsyche annae* n.sp. ♂. A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : pénis, vue latérale. D : pénis, vue ventrale. E : genitalia, vue dorsale. F : genitalia, vue ventrale.

- Lower branch of inferior appendage without dorsally directed process (Fig. 1 B) ; phallus with one pair of sclerous processes (Fig. 8 C), or two separate pairs (Fig. 3 F) ..... 8
- 8 Lower branch of inferior appendage, in ventral view, with a small distinct process oriented mesad (Fig. 3 D) ..... *H. bifida* sp.n.
- Lower branch of inferior appendage, in ventral view, without distinct mesad oriented process (Figs 1 F, 8 E) ..... 9
- 9 Upper branch of inferior appendage smoothly edged and triangular (Fig. 8 B) ; phallus with one pair of sclerous processes (Fig. 8 C) ..... *H. tanzanica* sp.n.
- Upper branch of inferior appendage sharply triangular (Fig. 1 B) ; phallus with two pairs of sclerous processes (Figs 1 C, D) ..... *H. annae* sp.n.

### 5. The species

#### *Helicopsyche annae* sp.n.

(Figs 1 A-F).

Type material : Holotype ♂ [ZMUC, in alcohol, except the genitalia and right wings which are in Canada balsam] : Tanzania : Iringa Region, Uzungwa Mts, Chita Forest Reserve, 1400 m, net, 1 Nov 1984 (M. Stoltze & G. I. Petersen).

Paratype 1 ♂ [in alcohol] : As holotype ; 1 ♂ [in alcohol] : As holotype, except Mwanihana Forest above Sanje, 1100 m., net, 1 Aug 1982 (M. Stoltze & N. Scharff).

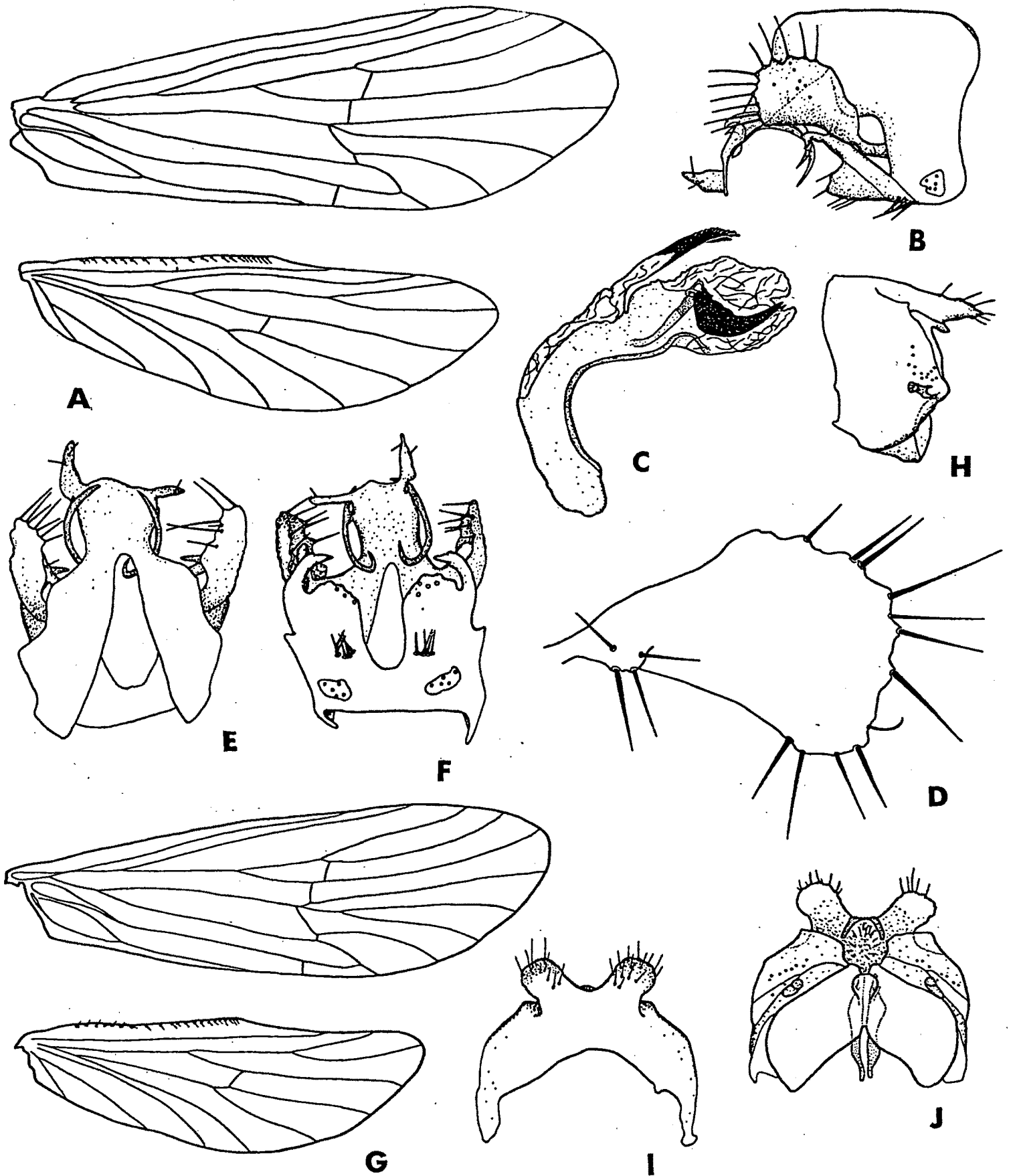


Fig. 2 (A-F) : *Helicopsyche barbata* sp.n. ♂ . A : anterior and posterior wings. B : genitalia, lateral view. C : phallus, lateral view. D : upper branch of inferior appendage, lateral view. E : genitalia, dorsal view. F : genitalia, ventral view. — (G-J) : *Helicopsyche barbata* sp.n. ♀ . G : anterior and posterior wings. H : genitalia, lateral view. I : genitalia, dorsal view. J : genitalia, ventral view.

Fig. 2 (A-F) : *Helicopsyche barbata* n.sp. ♂ . A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : pénis, vue latérale. D : branche supérieure de l'appendice inférieur, vue latérale. E : genitalia, vue dorsale. F : genitalia, vue ventrale. (G-J) : *Helicopsyche barbata* n.sp. ♀ . G : ailes antérieure et postérieure. H : genitalia, vue latérale. I : genitalia, vue dorsale. J : genitalia, vue ventrale.

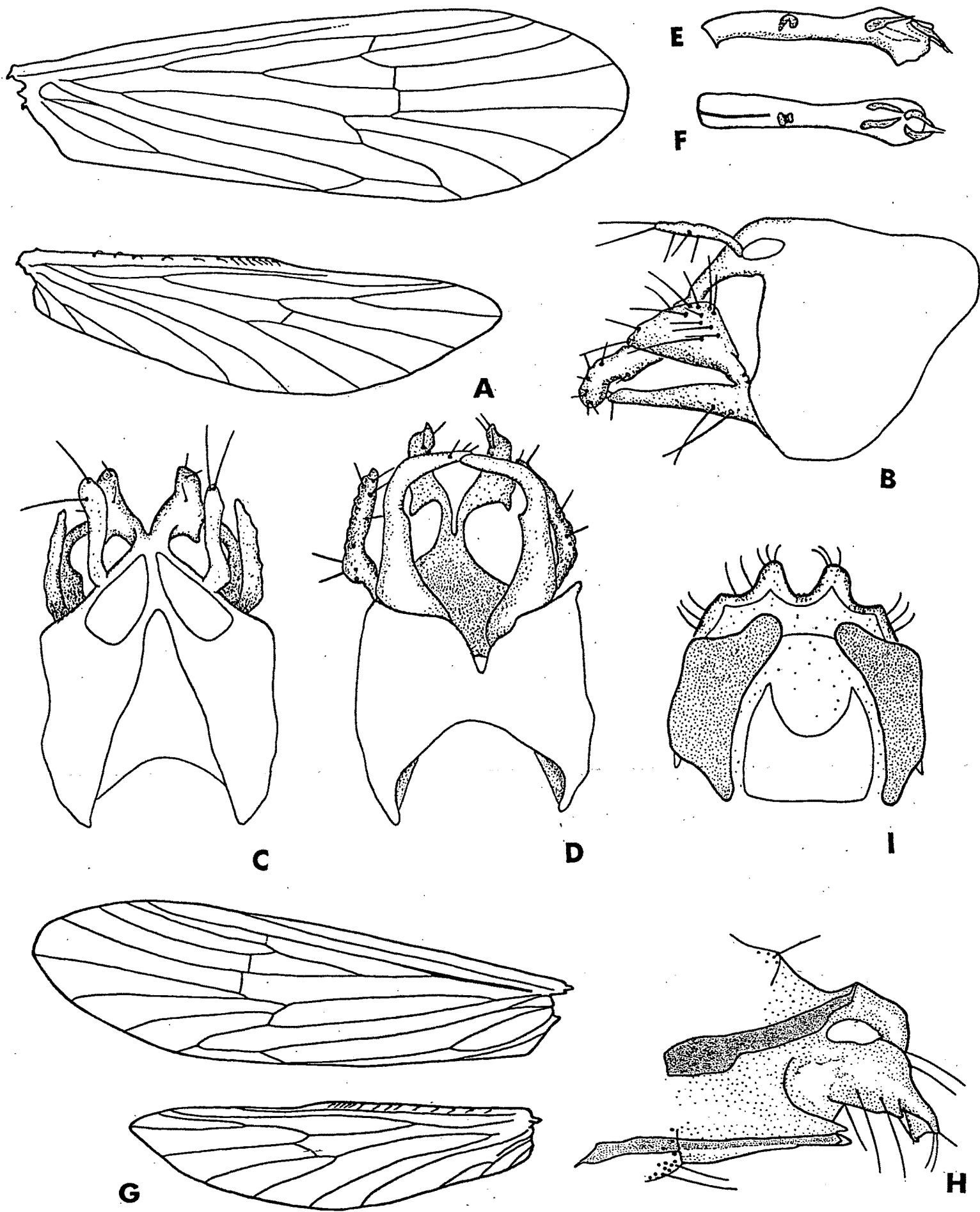


Fig. 3 (A-F) : *Helicopsyche bifida* sp.n. ♂ . A : anterior and posterior wings. B : genitalia, lateral view. C : genitalia, dorsal view. D : genitalia, ventral view. E : phallus, lateral view. F : phallus, ventral view. — (G-I) : *Helicopsyche bifida* sp.n. ♀ . G : anterior and posterior wings. H : genitalia, lateral view. I : genitalia, ventral view.

Fig. 3. (A-F) : *Helicopsyche bifida* n.sp. ♂ . A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : genitalia, vue dorsale. D : genitalia, vue ventrale. E : pénis, vue latérale. F : pénis, vue ventrale. — (G-I) : *Helicopsyche bifida* n. sp. ♀ . G : ailes antérieure et postérieure. H : genitalia, vue latérale. I : genitalia, vue ventrale.

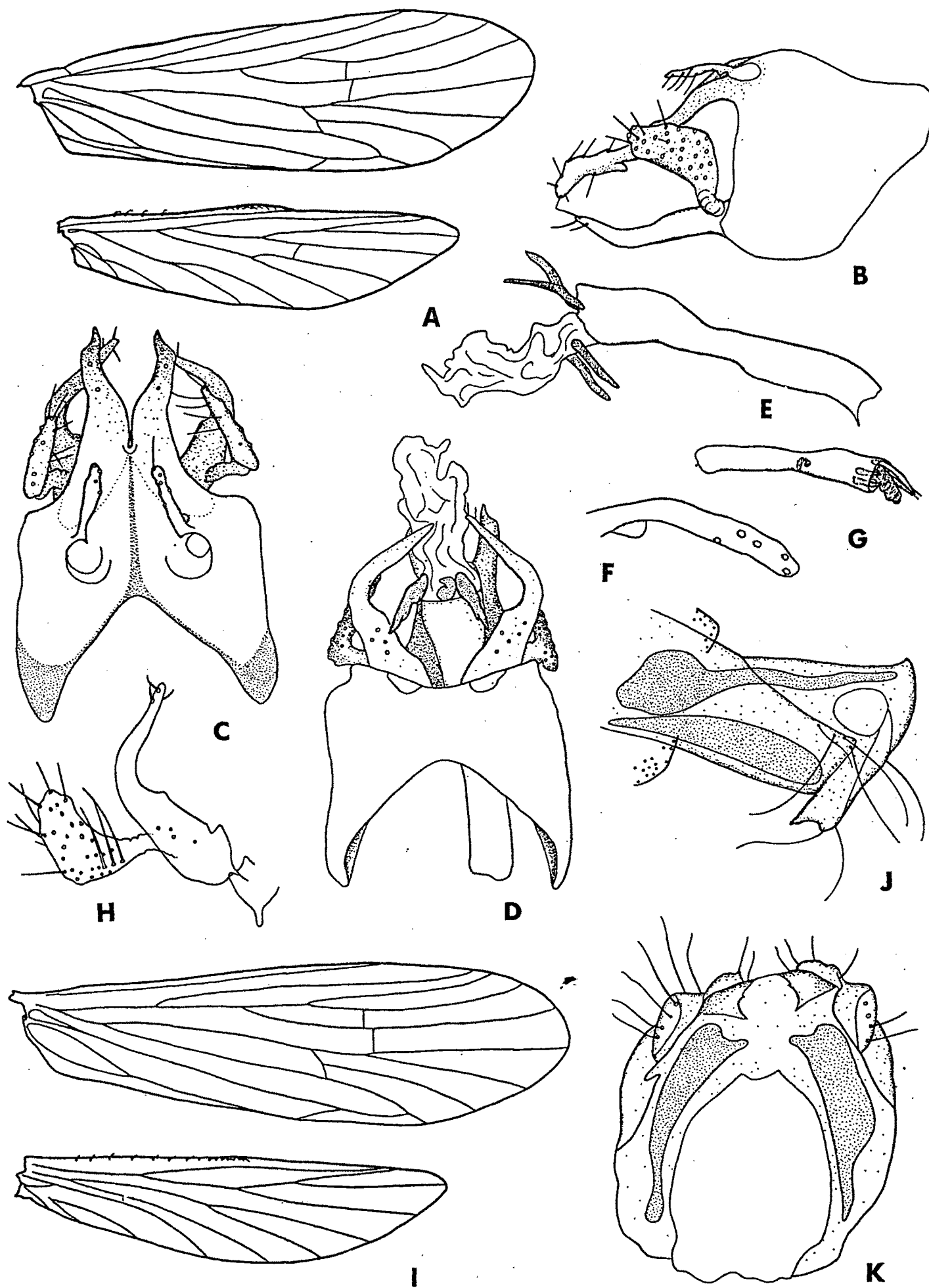


Fig. 4 (A-H) : *Helicopsyche jacquemarti* sp.n. ♂ . A : anterior and posterior wings. B : genitalia, lateral view. C : genitalia, dorsal view. D : genitalia, ventral view. E : phallus, lateral view. F : superior appendage, ventral view. G : phallus, ventrolateral view. H : upper and lower branches of inferior appendage in squeezed position. — (I-K) : *Helicopsyche jacquemarti* sp. n. ♀ . I : anterior and posterior wings. J : genitalia, lateral view. K : genitalia, ventral view.

Fig. 4. (A-F) : *Helicopsyche jacquemarti* n.sp. ♂ . A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : genitalia, vue dorsale. D : genitalia, vue ventrale. E : pénis, vue latérale. F : appendice supérieur, vue ventrale. G : pénis, vue latérale. H : branches supérieure et inférieure de l'appendice inférieur. — (I-K) : *Helicopsyche jacquemarti* n.sp. ♀ . I : ailes antérieure et postérieure. J : genitalia, vue latérale. K : genitalia, vue ventrale.

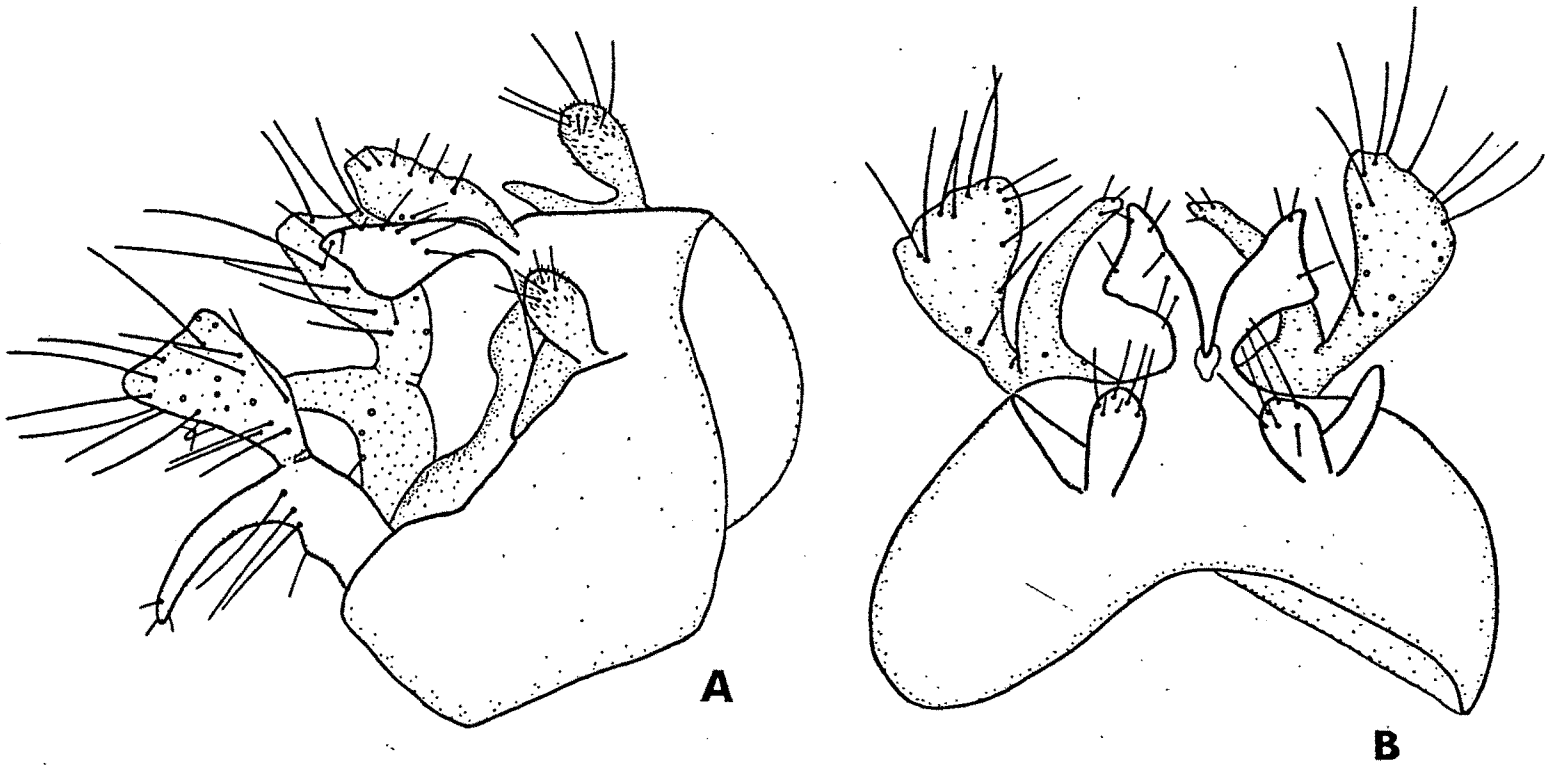


Fig. 5 (A-B) : *Helicopsyche marlieri* Jacquemart, 1957 ♂. A : genitalia, dorso-lateral view. B : genitalia, dorsal view.  
 Fig. 5 (A-B) : *Helicopsyche marlieri* Jacquemart, 1957 ♂. A : genitalia, vue dorso-latérale. B : genitalia, vue dorsale.

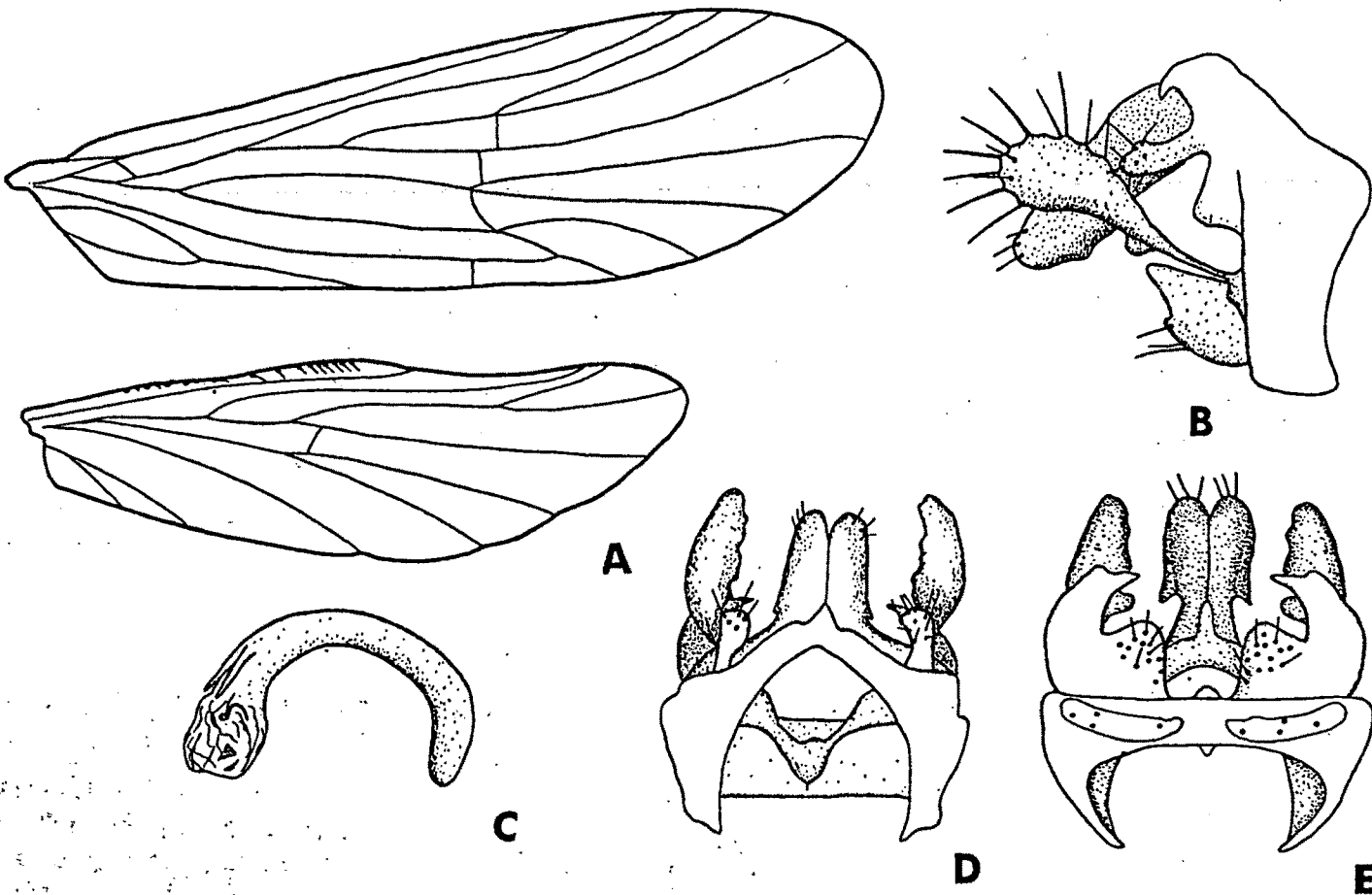


Fig. 6 (A-E) : *Helicopsyche pedunculata* sp.n ♂. A : anterior and posterior wings. B : genitalia, lateral view. C : phallus, lateral view. D : genitalia, dorsal view. E : genitalia, ventral view.  
 Fig. 6 (A-E) : *Helicopsyche pedunculata* n.sp. ♂. A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : pénis, vue latérale. D : genitalia, vue dorsale. E : genitalia, vue ventrale.



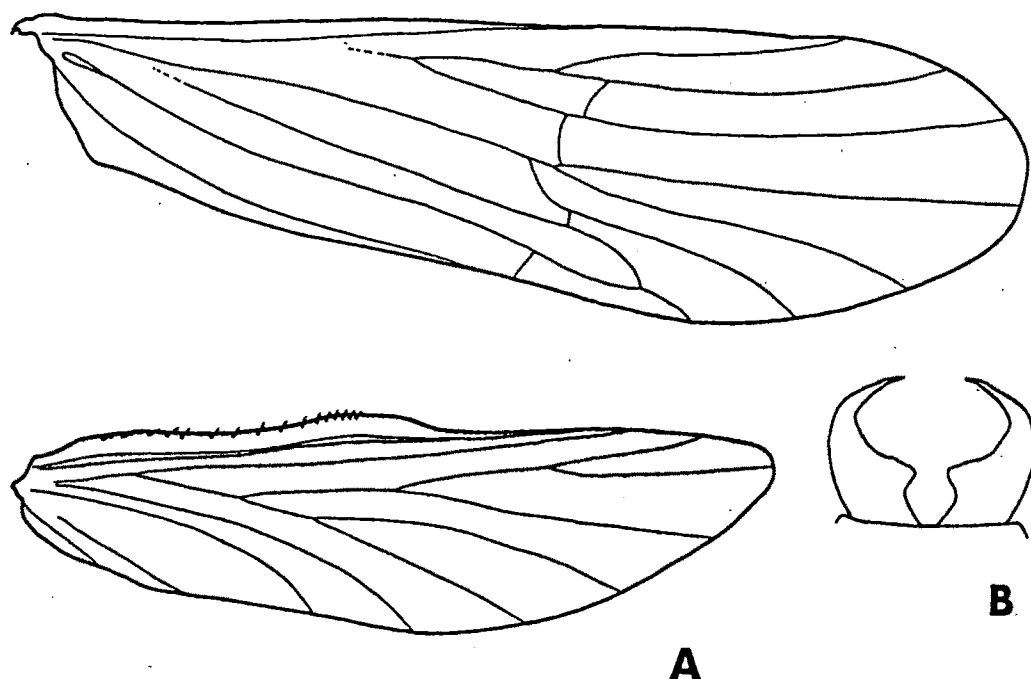


Fig. 7 (A-B) : *Helicopsyche stoltzei* sp.n. ♂ . A : anterior and posterior wings. B : lower branch of inferior appendage, ventral view.  
 Fig. 7 (A-B) : *Helicopsyche stoltzei* n.sp. ♂ . A : ailes antérieure et postérieure. B : branche inférieure de l'appendice inférieur, vue ventrale.

**Diagnosis** : Upper branch of inferior appendage sharply triangular. Phallus with two pairs of sclerous processes with wreath of microtrichia.

**Etymology** : *annae*, refers to Mrs. Anne Svare, my common-law partner.

**Description** :

**Male** (holotype, except when otherwise stated) : **Head** : Antennae broken. Eyes covering about 65 % of the head. **Wings** (Fig. 1 A) : Anterior wing : 3.5 mm (n=3). R2+3 branch well before crossvein R3-R4 ; R4+5 branch distally to, but close to crossvein R3-R4+5 ; R2 nearly twice the length of R2+3 ; A1+2 meets wing edge immediately before Cu2 ; Cu2 in angle of about 30° to wing edge (n=3) ; A3 present. Posterior wing : 2.8-2.7 mm (n=3) with 16 hamuli ; R2 nearly 1.5x the length of R2+3. **Legs** : Anterior legs with anterior spur 3x the length of the posterior spur (holotype and paratypes). **Genitalia** (Figs 1 B- F) : IXth segment long (Fig. 1 B), in ventral view strongly concave. Superior appendage thick, uniformly broad. Xth tergum club-shaped in lateral view (Fig. 1 B), strongly bifurcate, with several setae. Upper branch of inferior appendage sharply triangular, with posterior corner slightly protruded, as long as lower branch (Fig. 1 B) ; the lower branch is curved less than 90°. Phallus slightly curved ventrad, with two pairs of

sclerous processes having wreath of microtrichia (Figs 1 C, D).

**Female** : Unknown.

**Remarks** : Males of *H. annae* are very close to those of *Helicopsyche tanzanica* sp.n. but have upper branch of inferior appendage sharply triangular.

***Helicopsyche barbata* sp.n.**

(Figs 2 A-J).

**Type-material** : Holotype ♂ (ZMBN139, in Canada balsam) : Tanzania : Tanga Region, W. Usambara, Mazumbai, Kaputu stream, 1680 m., Malaise trap, 26-29 Nov 1990 (ZMBN Expedition).

Allotype ♀ (in Canada balsam) : As holotype, except 1450 m., 10-14 Nov 1990.

Paratypes 24 ♂ ♂, 80 ♀ ♀ (in alcohol and in Canada balsam) : As holotype, except 1400-1770 m., 28 Oct-4 Dec 1990 ; 2 ♀ ♀ (in alcohol) : Tanzania : Tanga Region, W. Usambara Mts, Lushoto, Gogolo, net, 25 Nov 1990 (ZMBN Expedition).

**Diagnosis** : Male antennae with 60 flagellomeres. Anterior wings longer than 6.0 mm in male and 8.5 mm in female. Male genitalia with stout black setae on IXth sternite ; Xth tergum with large phallus grip.

**Etymologie** : *barbata*, rom latin, *bearded*, referring to strong, black setae on IX-th sternite.



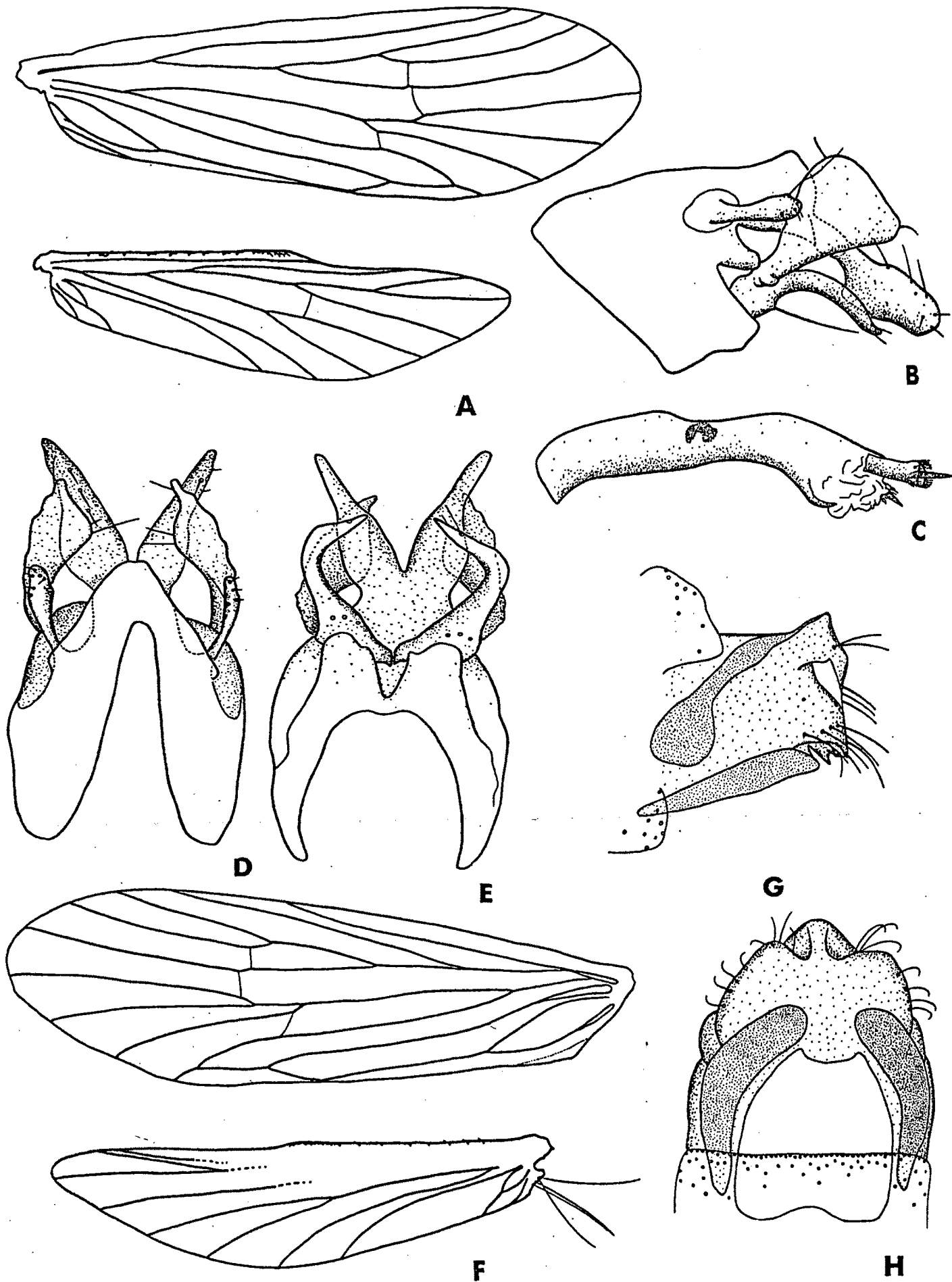


Fig. 8 (A-E) : *Helicopsyche tanzanica* sp.n. ♂ . A : anterior and posterior wings. B : genitalia, lateral view. C : phallus, lateral view. D : genitalia, dorsal view. E : genitalia, ventral view. — (F-G) : *Helicopsyche tanzanica* sp.n. ♀ . F : anterior and posterior wings. G : genitalia, lateral view. H : genitalia, ventral view.

Fig. 8. (A-F) : *Helicopsyche tanzanica* n.sp. ♂ . A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : pénis, vue latérale. D : genitalia, vue dorsale. E : genitalia, vue ventrale. — (F-G) : *Helicopsyche tanzanica* n.sp. ♀ . F : ailes antérieure et postérieure. G : genitalia, vue latérale. H : genitalia, vue ventrale.

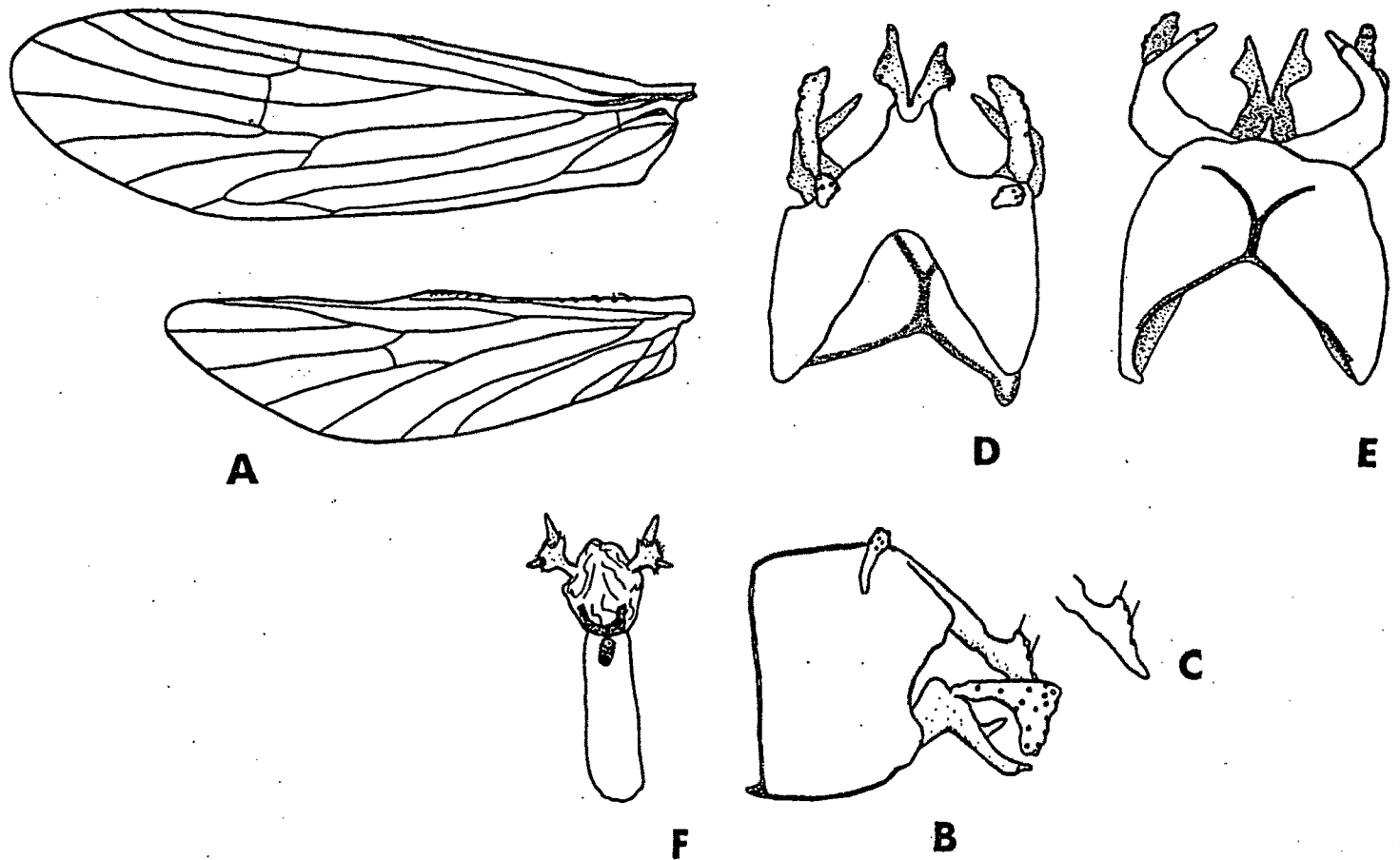


Fig. 9 (A-F) : *Helicopsyche ulugurensis* sp.n. ♂. A : anterior and posterior wings. B : genitalia, lateral view. C : distal part of Xth tergum, lateral view. D : genitalia, dorsal view. E : genitalia, ventral view. F : phallus, ventral view.

Fig. 9. (A-F) : *Helicopsyche ulugurensis* n.sp. ♂. A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : partie distale du tergite X, vue latérale. D : genitalia, vue dorsale. E : genitalia, vue ventrale. F : pénis, vue ventrale.

### Description :

**Male** (holotype except when otherwise stated) :

**Head** : Antennae with 60 flagellomères. Eyes covering 75-85 % of lateral part of head (n = 10). **Wings** (Fig. 2 A) : Anterior wing : 6.2-6.9 mm (mean : 6.6, n = 10) ; R2+3, and R4+5 separate before crossvein R3-R4 ; R2 about as long R2+3 ; crossvein M-Cu short ; A1+2 reaching wing edge before Cu2 ; Cu2 nearly right angled to posterior edge of wing ; length of R2 equal to R2+3 ; A3 absent. Posterior wing : 4.7-5.3 mm (mean : 5.0, n = 10), with 15-22 hamuli (mean : 19, n = 10). **Legs** : Anterior leg with anterior apical spur 1.4-2.0x the length of the posterior spur (n = 10). **Genitalia** (Figs 2 B-F) : IXth sternite with two membraneous areas. Superior appendage short, broad. Upper branch of inferior appendage with undulated margin (Fig. 2 D) ; lower branch mesally broad ; mesal margin undulated ; terminally on ventral part with stout, dark setae (Fig. 2 D). Xth tergum, in lateral view,

distally slender, with an apparently movable triangular appendage attached on dorsal side near apex ; long phallus grip present laterally. Phallus with two pairs of large sclerous processes ; the dorsal anterior pair faintly incised ; the posterior pair thorn-shaped, with distal part pointing dorsad.

**Female** (allotype) : **Head** : Antennae with 53 flagellomeres. Palps densely hairy. **Wings** (Fig. 2 G) : Anterior wings 8.4 mm ; venation as in male, but fork 3 present. Posterior wing 6.2 mm, with 21-23 hamuli (allotype and 3 paratypes). **Genitalia** (Figs 2 H-J) : with external part of VIIIth gonopods broad, both anteriorly and posteriorly deeply clefted. Internal part of IXth gonopods easily seen in ventral view (Fig. 2 J). Xth segment oriented posteriorly (Fig. 2 K) and easily seen in ventral view (Fig. 2 J) ; with several setae.

**Remarks** : Both males of *H. barbata* and *H. bifida* sp.n. have two membraneous areas present on IXth segment. In ventral view, the lower branch of inferior appendage

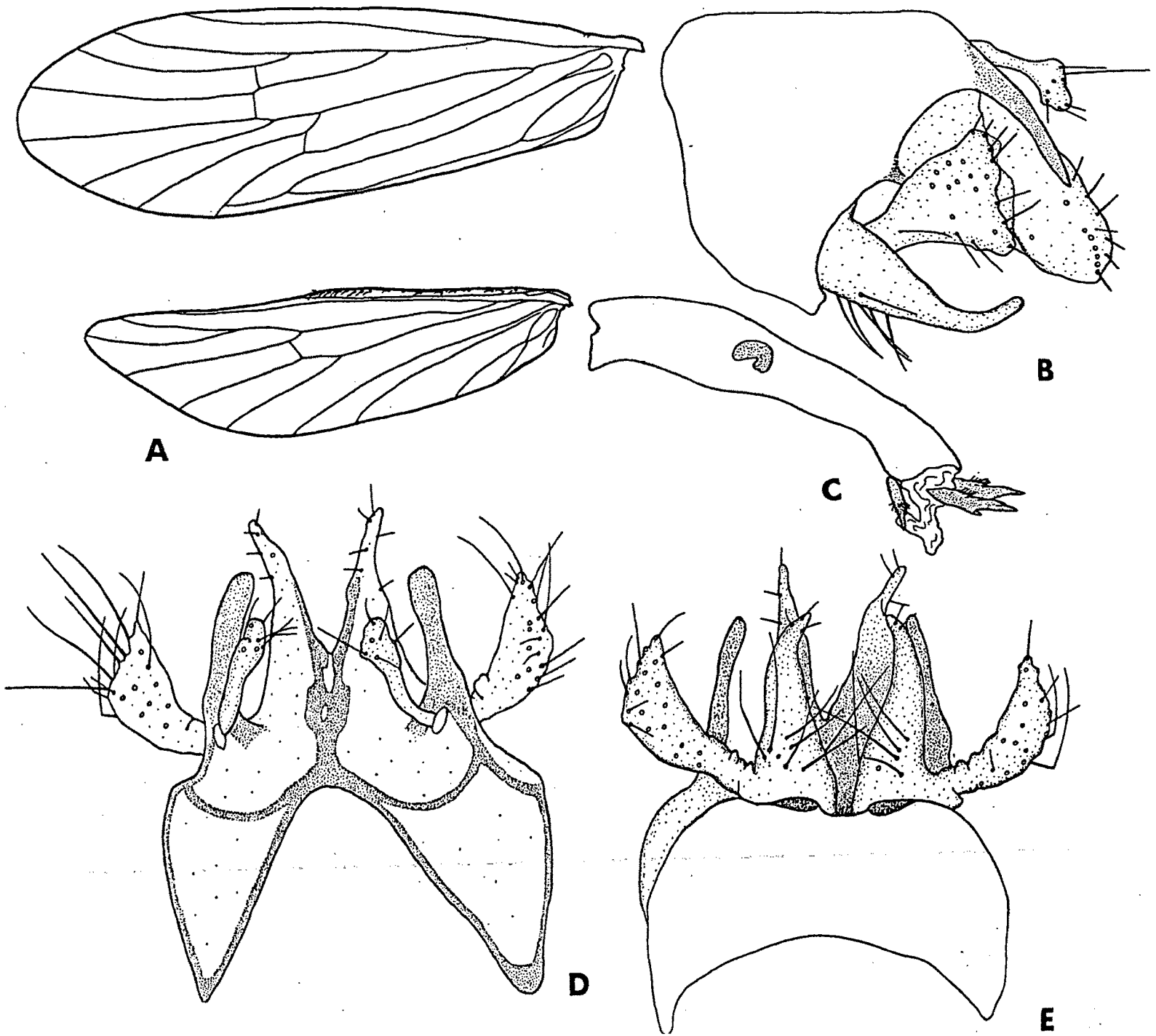


Fig. 10 (A-E) : *Helicopsyche usambarensis* sp.n. ♂. A : anterior and posterior wings. B : genitalia, lateral view. C : phallus, lateral view. D : genitalia, dorsal view. E : genitalia, ventral view.

Fig. 10 (A-E) : *Helicopsyche usambarensis* n.sp. ♂. A : ailes antérieure et postérieure. B : genitalia, vue latérale. C : pénis, vue latérale. D : genitalia, vue dorsale. E : genitalia, vue ventrale.

is broad mesally as in *H. pedunculata* sp.n., but in *H. barbata* the margin is undulated. Anterior sclerous processes on phallus more incised than in *H. jacquemarti* sp.n.

***Helicopsyche bifida* sp.n.**

(Figs 3 A-I).

**Type-material** : Holotype ♂ [ZMBN140, in Canada balsam] : Tanzania : Tanga Region, W. Usambara Mts, Mazumbai, Kaputu stream, 1540 m.,

Malaise trap, 31 Oct-2 Nov 1990 (ZMBN Expedition).

Allotype ♀ (in Canada balsam) : As holotype, except 1450 m., 19-23 Nov 1990.

Paratypes 74 ♂♂, 60 ♀♀ [in alcohol and Canada balsam] : As holotype, except 1400-1720 m., 2 Nov-3 Dec 1990 ; 3 ♂♂ [in alcohol] : Tanzania : Tanga Region, W. Usambara Mts, Kwama-

nolo West, net, 30 Nov 1990 (ZMBN Expedition) ; 7 ♂♂, 1 ♀ [in alcohol] : Tanzania : Tanga Region, W. Usambara Mts, Gogo South, net, 30 Nov 1990 (ZMBN Expedition).

**Diagnosis** : Upper branch of inferior appendage trianguloid ; distal part of lower branch with small mesad oriented process (Fig. 3 D). Phallus with anterior sclerous processes smooth ; the posterior pair have a single microtrichia.

**Etymology** : *bifida* rom Latin, *bis*, twice ; *findere*, to split, referring to inferior appendage being strongly bifurcate.

**Description** :

**Male** (holotype except when otherwise stated) : **Head** : Antennae with 33 flagellomeres (n=2 paratypes). Eyes large, covering about 90 % of the head (n=10). **Wings** (Fig. 3 A) : Anterior wing : 3.3-4.2 mm (mean : 3.8, n=10). R2+3 branch well before crossvein R3-R4+5 ; R4+5 branch at crossvein R3-R4+5 ; R2 about 1.5x the length of R2+3 ; Cu2 meets A1+2 at edge of wing ; Cu2 in 45° angle to posterior edge of wing. Posterior wing : 2.6-3.3 mm (mean : 3.0, n=10) ; with 13-17 hamuli (mean : 15, n=10) ; R2 short, less than 2/3 the length of R2+3 ; Cu and A3 present. **Legs** : Anterior leg with anterior apical spur 2.5-3.0x the length of the posterior spur (n=10). **Genitalia** (Figs 3 B-F) ; IXth and Xth segment long (Fig. 3 B) ; Xth tergum longer than inferior appendages, bifurcate, with incision reaching midway and with two membraneous areas near superior appendage. Superior appendage long, slender. Lower branch of inferior appendage distally curved at nearly 90 ° to base (Fig. 3 D) ; basally broader than distal part ; with small, mesad oriented, horn-like process (Fig. 3 D). Upper branch triangular (Fig. 3 B). Branches of inferior appendages of sub-equal length. Phallus (Fig. 3 E, F) nearly straight, posteriorly extended, with two pairs of sclerous processes, the anterior pair smooth, the posterior pair with a single microtrichia near apex.

**Female** (allotype, except when otherwise stated) : **Head** : Antennae with 34-35 flagellomeres (allotype and 2 paratypes). **Wings** (Fig. 3 G) : Anterior wing 4.2 mm ; venation as in male, but R4 and R5 separate after crossvein R3-R4 ; the length of R2 about 1.7x the R2+3. Posterior wing : 3.2 mm ; with 14 hamuli. R2 less than 1.5x the length of R2+3. **Genitalia** (Figs 3 H-I) : External part of VIIIth gonopods about as broad as long, posteriorly deeply concave

with pointed posterior corners (Fig. 3 I). IXth gonopods broad, with posterior dorsal edge rounded (Fig. 3 I). IXth segment laterally with three setae (Fig. 3 I). Xth segment with anterior and posterior lobes of equal length (Fig. 3 H). Cleft between Xth lobes and external part of IXth gonopods is broad.

**Remarks** : Males of *H. bifida* can easily be distinguished from *H. jacquemarti* sp.n. by the triangular upper branch of inferior appendage and by the superior appendage, which does not have a ventral process. The female genitalia are similar to those of *H. tanzanica* sp.n. and *H. jacquemarti* sp.n. However, in *H. bifida* the dorsal edge of Xth tergum is less pointed in lateral view, external part of VIIIth gonopods is shorter and more concave, and IXth gonopods are broader.

### *Helicopsyche jacquemarti* sp.n.

(Figs 4 A-K).

**Type-Material** : Holotype ♂ [ZMUC, in Canada balsam] : Tanzania : Morogoro Region, Uzungwa Mts, Mwanihana Forest above Sanje, 1000 m., net, 1 Aug 1981 (M. Stoltze & N. Scharff).

**Paratypes** : 6 ♂♂ [ZMUC, in Canada balsam] : as holotype except 1 Aug ; 2 ♂♂, 7 ♀♀ [ZMUC, in alcohol] : As holotype, except 1100 m., 1 Aug 1982 ; 16 ♂♂, 10 ♀♀ [ZMUC, in alcohol] : As holotype, except 400-1000 m., 1 Aug-21 Sept 1984 ; 6 ♂♂, 1 ♀, 1 ♂ pupa (ZMUC, in alcohol and Canada balsam) : Tanzania : Iringa Region, Uzungwa Mts, Chita Forest Reserve, 1300-1500 m., net, 26 Oct-10 Nov 1984 (M. Stoltze & G.I. Petersen) ; 2 ♂♂ [ZMUC, in alcohol] : Tanzania : Tanga Region, East Usambara Mts, Kwamkuyu, 900 m., net, 15 July 1980 (M. Stoltze & N. Scharff).

**Diagnosis** : The superior appendage basally with a small ventrad oriented process (Fig. 4 F). Xth tergum with distal part protruding slightly downward. The upper branch of inferior appendage sigmoid shaped, shorter than lower branch.

**Etymology** : *jacquemarti*, refers to S. Jacquemart who described the first *Helicopsyche* species from the African mainland.

**Description** :

**Male** : **Head** : Antennae broken in holotype and all paratypes. Diameter of eyes about 50 % of the head. **Wings** (Fig. 4 A) : Anterior wing : 3.5-3.8 mm (mean : 3.6, n=8) ; R2+3 branch proximally to crossvein R3-R4 ; R4+5 branch distally to crossvein

R3-R4 ; R2 very long, more than 2.5x longer than R2 + 3 ; A1 + 2 touch wing edge close to Cu2 ; Cu2 in angle of about 45 ° to wing edge ; A3 present. Posterior wing : 2.7-3.0 mm (mean : 2.8, n = 8), with 12-20 hamuli (mean : 15, n = 8) ; R2 slightly shorter than twice the length of R2 + 3. *Legs* : Anterior leg with anterior apical spur about 2.5x the length of the posterior spur (n = 8). *Genitalia* (Figs 4 B-H) : Superior appendage long, with terminal process directed ventrad. Upper branch of inferior appendage broadly sigmoid, shorter than lower branch ; lower branch with basal half slightly broader than distal half (Fig. 4 E, H). Xth tergum distally directed strongly ventrad (Fig. 4 B), with ventral process pointing anteriorad and a few dispersed setae distally. Phallus (Fig. 4 E, G) with two pairs of smooth sclerous processes, the ventral pair slightly incised.

*Female* : *Head* : Antennae with 36 flagellomeres (n = 1). *Wings* (Fig. 4 I) : Anterior wing as in male but 3.7-4.1 mm (mean : 3.9, n = 7) ; R2 slightly longer than R2 + 3. Posterior wings 2.8-3.2 (mean : 3.0, n = 7) ; R2 slightly shorter than twice the length of R2 + 3. *Genitalia* (Figs 4 J-K) : External part of VIIIth gonopods large, rounded, with posterior edge slightly concave ; about 1.5x longer than broad (Fig. 4 J). External part of IXth gonopods slender, posteriorly broader ; posteriorly pointed mesad. IXth segment with four lateral setae (Fig. 4 J, K) ; posterior dorsal edge strongly pointed (Fig. 4 K). Ventral part of Xth segment slightly directed anteriorly ventrad ; the anterior lobe longer than the posterior (Fig. 4 K). Cleft between Xth lobes and external part of IXth gonopods narrow.

*Remarks* : The lower branch of inferior appendage is close to that *H. bifida* in ventral view, but in *H. jacquemarti* this appendage is bent mesad slightly more proximally than in *H. bifida*. Xth tergum distally slightly more slender and more ventrad directed than *H. bifida*. The females are close to *H. bifida* and *H. tanzanica*, but have the posterior edge of the external part of the VIIIth gonopods less concave. The external part of the IXth gonopods with posterior edge more pointed, and ventral part of Xth segment with anterior lobe longer than the posterior.

***Helicopsyche marlieri* Jacquemart, 1957.**

(Fig 5 A-B).

*Diagnosis* : Antennae with  $\pm$  43 flagellomeres ; superior appendage bifid, Xth tergite short. Phallus with two pairs of sclerous processes, the posterior pair with distal wreath of microtrichia.

***Redescription* :**

*Male* : *Head* : Antennae with  $\pm$  43 flagellomeres (holotype and paratypes).

*Genitalia* (Figs 5 A-B) : IXth and Xth segment short ; superior appendage short and posteriorly extended ; with additional process ventrally to superior appendage, about as long as superior appendage. IXth segment without membraneous area ; sternum short, terminally split, slightly triangular (Fig. 5 B) ; stout setae present dorsally. Upper and lower branch of inferior appendage of equal length. The lower branch with three short setae at apex ; with curving point about halfway its length, with long setae (Fig. 5 A). The upper branch slightly triangular. Phallus (Jacquemart, 1957 : fig. 20) with two pairs of sclerous processes ; the anterior pair with single setae near apex ; the posterior pair with distal wreath of microtrichia. Posterior part of phallus slightly curved dorsad.

*Female* : Unknown.

*Remarks* : Both *H. marlieri* and *H. usambarensis* sp.n. have sclerotized processes dorsally on IXth segment, close to the superior appendage. In *H. marlieri* this process is as long as the superior appendage, while in *H. usambarensis* it is longer. The superior appendage is much longer in *H. usambarensis* than in *H. marlieri*. Also *H. usambarensis*, *H. tanzanica* sp.n., *H. ulugurensis* sp.n. and *H. annae* have sclerous processes on phallus with a wreath of microtrichia. In *H. annae*, *H. jacquemarti* and to some extent *H. usambarensis*, the microtrichia are present on both pairs. *H. tanzanica* has a wreath of microtrichia on the single present pair of phallus processes.

*Material examined* : Holotype ♂ pupa [IRSNB in Canada balsam] : Zaïre : Nyaleka River, downstream of Semliki, Sector Vieux-Béni, 900 m., 9 Feb 1956 (G.F. de Witte).

Paratypes 2 ♂ ♂ pupae and 4 larvae [IRSNB in Canada balsam] : As holotype.

***Helicopsyche pedunculata* sp.n.**

(Figs 6 A-E).

*Type-material* : Holotype ♂ [ZMBN141, in Canada balsam] : Tanzania : Tanga Region, W. Usambara Mts, Mazumbai, Kaputu stream, 1680 m., Malaise trap, 31 Oct-2 Nov 1990 (ZMBN Expedition).

*Diagnosis* : Anterior wings with crossvein M1 + 2-M3 + 4 on level with M3-Cu1.

**Etymology** : *pedunculata*, rom Latin, *pedunculus*, small foot, referring to the upper branch of inferior appendage being stalked.

**Description** :

**Male** : **Head** : Antennae brown, with 50 flagellomeres. Eyes small, covering about 75 % of the lateral part of head. **Wings** (Fig. 6 A) : Anterior wing 4.4 mm ; R2 + 3 branches close to crossvein R3-R4 ; R4 + 5 branches before crossvein R3-R4 ; R2 about 1.5x longer than R2 + 3 ; crossvein M-R short ; A1 + 2 reaching wing edge well before Cu2 ; Cu2 in right angle to wing edge ; A3 absent. Posterior wing : 3.4 mm ; with 14 hamuli. R2 short, only slightly longer than half the length of R2 + 3. **Legs** : Anterior leg with anterior apical spur 2x the length of the posterior spur. **Genitalia** (Figs 6 B-E) : IXth segment narrow, sternite with two membranous areas (Fig. 6 E). Superior appendage thick. Upper branch of inferior appendage drop-shaped, about twice the length of lower branch (Fig. 6 B) ; terminal part of lower branch, in ventral view, with broad process oriented mesad and distally corniform. Xth tergum short and thick in lateral view, the distal part slightly thicker than basal part (Fig. 6 B), dorsally with four pairs of short setae ; in dorsal view, distally bifurcate and with three pairs of setae dorsally on distal part. Phallus with one pair of long, smooth sclerous processes located dorsally ; an additional pair of small, diffuse, triangular sclerous processes are present ventrally near apex (Fig. 6 C).

**Female** : Unknown.

**Remarks** : The lower branch of the inferior appendage is similar to that of *H. barbata*. The Xth tergum is very similar to the shape in *Helicopsyche bacescui* Orghidan & Botosaneanu, 1953, but is distally more rounded. Phallus has a dorsal pair of sclerous processes of similar shape as *H. bacescui*. The ventral trianguloid pair of sclerous processes is similar, and apparently homologous to those of *Helicopsyche arenaria* Ross, 1975 and *Helicopsyche koumaca* Ross, 1975 from New Caledonia.

***Helicopsyche stoltzei* sp.n.**

(Figs 7 A-B).

**Type-material** : Holotype ♂ [ZMUC, in alcohol, wings in Canada balsam] : Tanzania : Morogoro Region, Uzungwa Mts, Mwanihana Forest, above Sanje, 1100 m., net, 1 Aug 1982. (M. Stoltze & N. Scharff, ZMUC).

**Diagnosis** : Male wings narrow. Male genitalia with lower branch of inferior appendage basally dilated and with mesad directed, rounded process. Xth tergum with short phallus grip.

**Etymology** : *stoltzei*, refers to Mr. Michael Stoltze, ZMUC.

**Description** :

**Male** : **Head** : Antennae light brown, with 39 flagellomeres. Eyes covering about 90 % of the head. **Wings** (Fig. 7 A) : Anterior wing 4.2 mm, narrow ; R1 not visible ; both R2 + 3 and R4 + 5 branch some distance before crossvein R3-R4 ; R2 2x the length of R2 + 3 ; crossvein R-M short. A1 + 2 reaching wing edge close to Cu2 ; Cu2 in angle of about 70 ° to wing edge. Posterior wing narrow, 3.0 mm, with 16 hamuli. R2 of equal length as R2 + 3. **Legs** : Anterior leg with anterior apical spur 1.6x the length of the posterior spur. **Genitalia** (Fig. 7 B) in ventral view : Lower branch of inferior appendage approximately evenly curved ; slightly shorter than the upper branch ; basally dilated with mesad directed, rounded process ; terminally pointed. Xth tergum terminally bifurcate ; laterally with short phallus grip.

**Female** : Unknown.

**Remarks** : Unfortunately, the genitalia of *H. stoltzei* are lost. However, a drawing produced by Stoltze clearly shows the distinctive features of this species, particularly by the shape of the lower branch of inferior appendage. The figure (Fig. 7 B) is reproduced from Stoltze's sketch which includes additional details.

***Helicopsyche tanzanica* sp.n.**

(Figs 8 A-H).

**Type-material** : Holotype ♂ [ZMUC, in Canada balsam] : Tanzania : Iringa Region, Uzungwa Mts, Chita Forest Reserve, 1500 m., net, 10 Nov 1984 (M. Stoltze & G.I. Petersen).

Allotype ♀ [ZMUC, in Canada balsam] : As holotype, except 1300 m, 26 Oct.

Paratypes : 8 ♂ ♂ [ZMUC, in alcohol] : As holotype, except 1300-1500 m., 26 Oct-10 Nov ; 1 ♂ [ZMUC, in alcohol] : Tanzania : Morogoro Region, Uzungwa Mts, Mwanihana Forest above Sanje, 1000 m., net, 1 Aug 1981 (M. Stoltze & N. Scharff) ; 2 ♂ ♂ [ZMUC, in alcohol] : Same data, except 1400 m., 14-16 Aug ; 39 ♂ ♂, 4 ♀ ♀ [ZMUC, in alcohol] : same data, except



1000-1500 m., 21-28 Sept 1984 (M. Stoltze & G.I. Petersen); 21 ♂♂, 12 ♀♀ [ZMUC, in alcohol]: Tanzania, Iringa Region, Mufindi, Kigogo Forest, 1700 m., net, 10 Oct 1984 (M. Stoltze & G.I. Petersen).

**Diagnosis**: Xth tergum club-shaped in lateral view, distal part with rounded margin. Upper branch of inferior appendage rounded, triangular; phallus with one pair of sclerous processes having wreath of microtrichia.

**Etymology**: *tanzanica*, refers to Tanzania.

**Description**:

**Male** (holotype except when otherwise stated):

**Head**: Antennae with 33 flagellomeres ( $n =$  holotype and 1 paratype). Eyes slightly smaller than 50% of the diameter of the head. **Wings** (Fig. 8 A): Anterior wing: 3.5-4.5 mm (mean: 4.0,  $n = 10$ ); venation as in *H. annae*, but R2 slightly longer, about 1.6x the length of R2+3. Posterior wing: 2.7-3.4 mm (mean: 3.1,  $n = 10$ ); with 12-16 hamuli (mean: 14,  $n = 10$ ); venation as in *H. annae*, but R2 slightly longer than R2+3. **Legs**: Anterior leg with anterior apical spur 2-3x the length of the posterior spur ( $n = 10$ ). **Genitalia** (Figs 8 B-E): IXth segment long (Fig. 8 B); in ventral view strongly concave. Superior appendage long, thick, club-shaped in lateral view. Xth tergum club-shaped in lateral view (Fig. 8 B), strongly bifurcate in dorsal view, with several setae (Fig. 8 D). Upper branch of inferior appendage triangular with rounded corners, as long as lower branch (Fig. 8 B); lower branch curved in an angle of about 90°. Phallus (Fig. 8 C) slightly curved ventrad, with one pair of sclerous processes having wreath of microtrichia.

**Female** (allotype): **Wings** (Fig. 8 F): Anterior wing: 3.4 mm; venation as in male, but R2 1.5x the length of R2+3. Posterior wing 2.7 mm, with 14 hamuli; venation in the middle of the wing diffuse. **Genitalia** (Figs 8 G-H): External part of VIIIth gonopods extended posteriorly, anterior and posterior edge slightly concave (Fig. 8 H); gonopods IX narrow, sigmoid, slightly broader terminally; posterior dorsal edge of IXth tergite horn-like pointed in lateral view (Fig. 8 G). IXth segment with four lateral setae. The Xth lobes directed ventrad (Fig. 8 G); cleft between Xb and posterior edge of IXth gonopods narrow (Fig. 8 G).

**Remarks**: Male with lower branch of inferior appendage as in *H. ulugurensis* sp.n., *H. marlieri* and *H. jacquemarti*. These species can, however, easily be separated by other characters.

***Helicopsyche ulugurensis* sp.n.**

(Figs 9 A-F).

**Type-material**: Holotype ♂ [ZMUC, in Canada balsam]: Tanzania: Morogoro Region, Uluguru Mts, Lupanga East, 1000 m., net, 10 July 1981 (M. Stoltze & N. Scharff).

**Diagnosis**: A1+2 fuse with Cu1b before wing edge. Upper branch of inferior appendage boot-shaped in lateral view; lower branch with acute dorsomedial process. Xth tergum with dorsolaterally oriented process. Phallus with sclerous processes on peduncle.

**Etymology**: *ulugurensis*, refers to Uluguru Mts, the type locality of this species.

**Description**:

**Male**: **Head**: Antennae broken in holotype. Eyes slightly broader than head. **Wings** (Fig. 9 A): Anterior wing: 4.0 mm. Crossvein R1-R2 present, on line with basal R2; R2+3 branch before crossvein R3-R4; R2 about 1.5x the length of R2+3; R5 branches from R4 in the posterior corner of Dc; Cu2 fused with A1+2 before A1+2 meets wing edge; Cu2 angled about 30° to wing edge; A3 absent. Posterior wing: 3.1 mm with 14 hamuli; R2 long, nearly 3x the length of R2+3; A3 present. **Legs**: Anterior leg with anterior apical spur 3x the length of the posterior spur. **Genitalia** (Figs 9 B-F): Superior appendage long, distally extended. Upper branch of inferior appendage inverted, boot-shaped; lower branch with dorsally oriented process (Fig. 9 B). Xth tergum with dorsolaterad oriented process (Figs 9 B, C). Phallus with anterior and posterior sclerous processes inserted on peduncle (Fig. 9 F), bases surrounded by microtrichia.

**Female**: Unknown.

**Remarks**: Lower branch of inferior appendage very similar to those of *H. marlieri*, *H. tanzanica* and *H. jacquemarti*. The Xth tergum is close to that of the New Caledonian *Helicopsyche edmundsi* (Ross 1975), but is shorter and lacks what Ross (1975) termed macrochaetae.

***Helicopsyche usambarensis* sp.n.**

(Figs 10 A-E).

**Type-material**: Holotype ♂ [ZMUC, in Canada balsam]: Tanzania: Tanga Region, E. Usambara



Mts, Sigi River, 500 m., net, 1 Sept 1981 (M. Stoltze & N. Scharff).

Paratype 1 ♂ [in alcohol] : As holotype, except 15 July 1980.

*Diagnosis* : Male genitalia dorsally with long sclerous processes on IXth segment ; lower branch of inferior appendages only slightly curved.

*Etymology* : *usambarensis*, refers to Usambara Mts, the type locality of this species.

*Description* :

*Male* : *Head* : Antennae broken. Eyes slightly larger than half the diameter of lateral part of head.

*Wings* (Fig. 10 A) : Anterior wing : 4.7 mm (holotype) ; R2 + 3 branch before crossvein R3-R4 ; R4 + 5 branch after, but close to crossvein R3-R4 ; R2 nearly 2x the length of R2 + 3 ; A1 + 2 fuses with Cu1 without meeting wing edge. Posterior wing : 3.7 mm, with 19 hamuli ; R2 nearly 2x the length of R2 + 3 ; A3 present. *Legs* : Anterior leg with anterior apical spur 2.5x the length of the posterior spur.

*Genitalia* (Figs 10 B-E) : Superior appendage long, distally extended. IXth segment with long sclerotized process close to superior appendage. Branches of inferior appendage strongly divergent ; upper branch triangular (Fig. 10 B) ; lower branch only slightly curved mesad, with long setae (Fig. 10 E). Xth tergum distally thick and rounded (Fig. 10 B). Phallus (Fig. 10 C) with two pairs of sclerous processes bearing small microtrichia mesally.

*Female* : Unknown.

*Remarks* : The sclerotized process close to the superior appendage is longer than in *H. marlieri*. The phallus have sclerous processes as in *H. bifida* and *H. barbata*, but with many microtrichia.

## 6. Habitat observations

Several unassociated larvae were collected in Kaputu stream. The cases were found attached to the upper surface of stones, some even above the water surface. The stream was surrounded by dense virgin moist forest, and the stream bottom was mainly composed of gravel and stones in different size classes (see Andersen & Johanson 1993). Hydrochemical characteristics were measured both in Kaputu stream (Andersen & Johanson 1993) and Nyaleka River (Jacquemart 1957). Unfortunately, only few common parameters have been measured. The pH in Kaputu was slightly lower than in Nyaleka,

but the chloride concentration was nearly 2.5 times higher in Kaputu than in Nyaleka. One conspicuous difference is the concentrations of  $\text{SO}_4^{2-}$ , which in Nyaleka River was over ten times higher than that found in Kaputu. Further, the total salinity in Nyaleka River was nearly three times higher than the total amount of suspended dry material in Kaputu. The differences in the ion-concentrations between Kaputu and Nyaleka may perhaps be due to local differences in geology, but could also reflect natural seasonal and yearly variations. Further information on the habitats along the Kaputu stream gradient, as well as records of other Trichoptera taxa found, is given in Andersen and Johanson (1993).

The larvae found in East Usambara, Uluguru and Uzungwa Mts were all found in similar habitats to those in the West Usambara Mts (Michael Stoltze pers. comm.). No hydrochemical data exist from these streams.

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