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Two new species of the *Drosophila simulivora* group (Diptera, Drosophilidae)

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Drosophila (Drosophila) enhydrobia n. sp. and *Drosophila (Drosophila) hydroessa* n. sp., both belonging to the *simulivora* species group, are described from specimens whose larvae were predating upon eggs and larvae of *Simulium* species in Tanzania.

Keywords: *Drosophila,* new species, *Simulium*, biology, Tanzania.

INTRODUCTION

The *Drosophila simulivora* species group was established for a small group of closely related species with aquatic larvae which, so far as is known, are predators of the eggs and larvae of various *Simulium* species (Simuliidae) and also of those of Chironomidae and Odonata (Aubertin 1937; Smart 1937; Tsacas & Disney 1974; Disney 1975; Gouteux 1976; Tsacas & Legrand 1979; Werner & Pont 2003). Because of this very peculiar biological background, the potential of the species of the *simulivora* group for the biological control of African blackflies has been discussed (Raybould & Grunewald 1975a, 1975b).

In general, the larvae and/or puparia of the *simulivora* group species are collected in aquatic biotopes and several authors (e.g. Smart 1937; Tsacas & Disney 1974; Disney 1975; Gouteux 1976; Tsacas & Legrand 1979) have provided descriptions of the early stages. The descriptions of adults are evidently based on specimens which have emerged from puparia, even if this is not explicitly stated.

MATERIAL AND METHODS

Flies and puparia from the collections of the Natural History Museum, London, U.K., have been made available by Adrian C. Pont. The puparia were collected by J. R. Raybould from two adjacent rivers in Tanzania from patches of *Simulium* (eggs and) larvae, and adult flies were allowed to hatch and then were preserved in alcohol. All specimens including the types are deposited in the Natural History Museum, London.

The flies were kept in 70% ethanol for more than 20 years under suboptimal conditions before being pinned: they have almost completely lost their colour and many setae are absent, distorted or partially broken. As a consequence, the following descriptions are incomplete and do not include any colour characters.

Descriptive terms, indices etc. are as described by Bächli et al. (2004). The preparations of terminalia and the drawings have been made by the second author (LT).

SYSTEMATICS

Genus *Drosophila* Fallén, 1823, subgenus *Drosophila* s.str.

simulivora species group Tsacas and Disney, 1974

Diagnosis. Flies of medium size (2-3 mm); all branches of the arista short (e.g. in *D. gibbinsi* Aubertin, *D. cogani* Tsacas and Disney, *D. enhydrobia* n. sp., *D. hydroessa* n. sp.) or very remarkably short (in *D. simulivora* Tsacas and Disney); usually two smaller setae preceding the anterior dorsocentral setae; scutellar setae of equal length, anterior pair converging; wings hyaline; costal fringe extended to the end of R_{4+5}; C index larger than 2.4; aquatic larvae which are predators of the eggs and larvae of various aquatic insects.

Taxa included. *D. cogani* Tsacas and Disney, 1974, *D. enhydrobia* n. sp., *D. gibbinsi* Aubertin, 1937, *D. hydroessa* n. sp., *D. libellulosa* Tsacas and Legrand, 1979, *D. simulivora* Tsacas and Disney, 1974.

Drosophila enhydrobia n. sp.

(Fig. 1)

Diagnosis. Carina relatively narrow, dorsally almost sharp; 7 prensisetae; paraphysis long, slim, completely covered with microtrichia.

Material examined. Holotype ♂: Tanzania Dodwe R. Amani 15.07.[19]75 J. Raibolt [sic] / microvial / Drosophila s. str. enhydrobia Holotype n. sp. L. Tsacas det. 2003 / Drosophila enhydrobia n. sp. Bächli & Tsacas det. / HOLOTYPE.
Paratype ♂: cardboard mount with puparium / Tanzania Dodwe R. Amani 15.07.[19]75 J. Rayboult [sic] / wild caught Dodwe Amani 16/5/[19]75 / microvial / Drosophila s. str. enhydrobia n. sp. L. Tsacas det. 2003 / Drosophila enhydrobia n. sp. Bächli & Tsacas det. / PARATYPE.
Paratype ♀: Tanzania - Dodwe river Amani 15.07.1981 (Coll. Raybould) / Drosophila enhydrobia n. sp. Bächli & Tsacas det. / PARATYPE.

Type locality. Dodwe River, near Amani, Tanzania.

Description, mainly based on the holotype (data from the male paratype in parentheses).

♂. Head. Frons generally microtrichose, slightly darker in the upper half, with about 6 fine, scattered interfrontal setulae; frontal length about 0.24 (0.27) mm; frontal index = 0.61 (0.80), top to bottom width ratio = 1.22 (1.25). Frontal triangle not clearly defined but appears to be pointed anteriorly; ocellar triangle prominent, about 55 % of frontal length. Orbital plates anteriorly divergent from eye margin, shining, broadened in anterior half, distinctly narrowed behind, about 85 % of frontal length. Mid orbital seta fine, placed close behind and slightly outside of anterior one, distance of or3 to or1 = 55 % of or3 to vtm, or1 / or3 ratio = 0.53 (0.56), or2 / or1 ratio = 0.70 (0.78); postvertical setae strong, crossed, about 110%, ocellar setae about 115% of frontal length. One vibrissa, followed by 3 fine oral setae and 2 genal setae which are stronger than the vibrissa. Carina almost parallel-sided, relatively narrow, dorsally almost sharp, slightly nose-like, highest area in lower third. Cheek index about 5. Eye index = 1.18 (1.24). Flagellomere 1 whitish, slightly longer than pedicel, length to width ratio about 1.2. Arista partially destroyed but clearly with very short upper and lower branches. Palpus relatively broad, with about 5 marginal setae.

enhydrobia

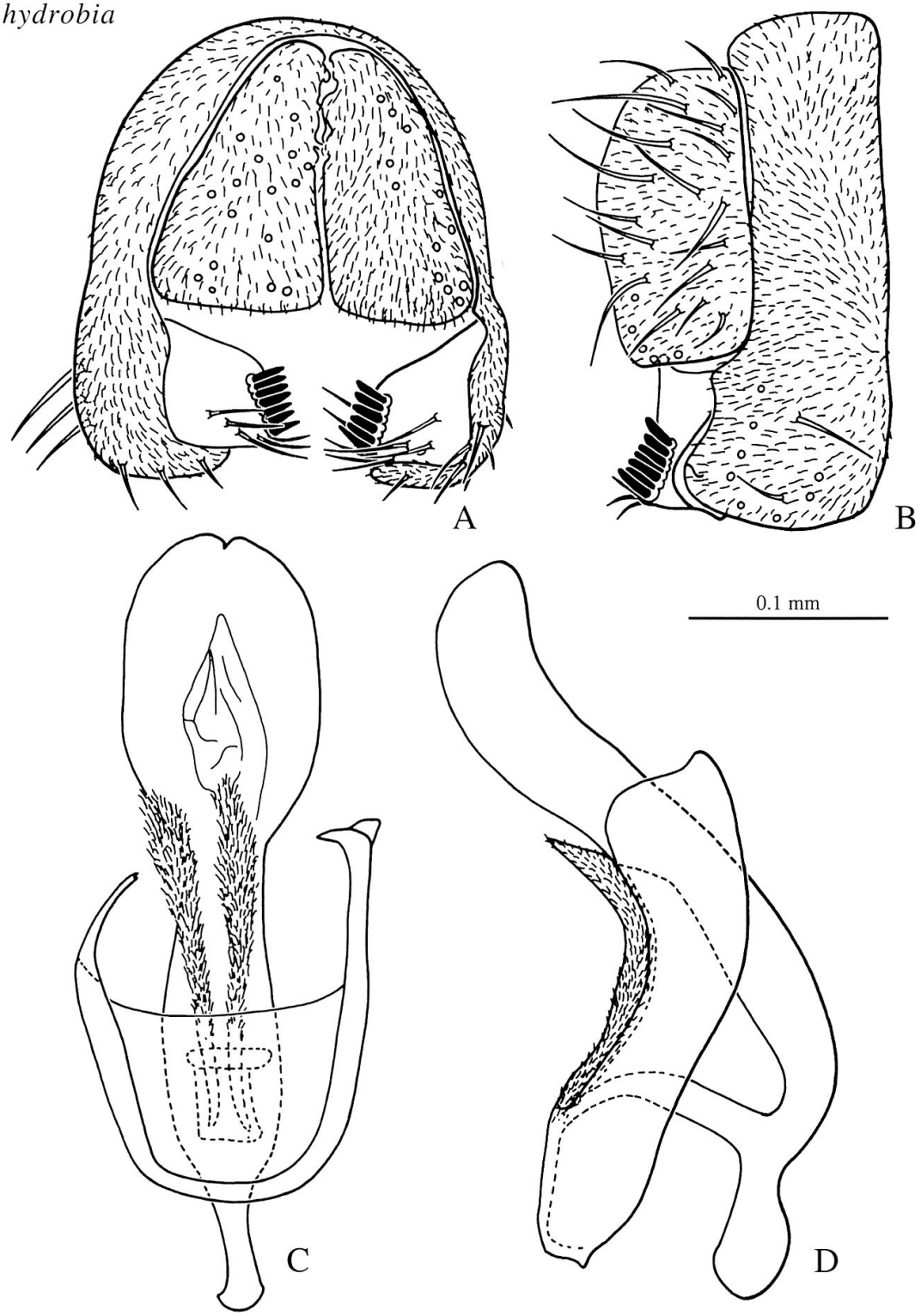


Fig. 1. *Drosophila enhydrobia* n. sp., holotype male: A, Epandrium, cerci and surstyli, posterior view. B, idem, right lateral view. C, hypandrium, aedeagus+aedeagal apodeme and paraphyses, posterior view. D, idem, right lateral view.

Thorax length 1.2 mm. Scutum medially indistinctly darker, acrostichal setae rubbed off. h index = 1.25. Transverse distance of dorsocentral setae about 160 % of longitudinal distance, dc index = 0.75; 2 additional dorsocentral setae present before the anterior one, distinctly decreasing in length. Scutellum paler than scutum, scutellar setae nearly equidistant; basal ones convergent, apical ones crossed, tips almost at the same level; scut index = 1.2. Haltere pale. Front tarsomere ratio about 1.4.

Wing hyaline; length 2.4 (2.3) mm. Indices: C = 2.59 (2.64), ac = 2.40 (2.00), hb = 1.0, 4C = 0.89, 4v = 1.68 (1.78), 5x = 1.29 (1.43), M = 0.47 (0.56), prox. x = 0.53 (0.56).

♂ terminalia (Fig. 1). Epandrium broad in lateral view, slightly broadened downwards, completely covered with microtrichia. Cerci completely covered with microtrichia, with about 25 irregularly placed longer setae, lower margin straight. Surstylus trapezoid, bare, with 7 prensisetae arranged in a line and 5-9 setae arranged along the ventral margin. Hypandrium broad in lateral view, bare, dorsal arch absent, gonopods indistinct (probably membraneous). Aedeagus sigmoid in lateral view, apically strongly broadened in posterior view. Aedeagal apodeme about 1/5 length of aedeagus, slightly broadened in lateral view. Paraphyses long, slim, completely covered with dense microtrichia.

♀. Measurements: Frontal length 0.3 mm; frontal index = 0.7, top to bottom width ratio = 1.2. or1 / or3 ratio = 0.6, or2 / or1 ratio = 0.4, postvertical setae = 88 %, ocellar setae = 112 % of frontal length. Cheek index about 4. Eye index = 1.11. Thorax length 1.45 mm. h index = 1.18. scut index = 1.00. Wing length 2.90 mm. Indices: C = 2.43, ac = 2.33, hb = 1.00, 4C = 0.84, 4v = 1.40, 5x = 1.22, M = 0.44, prox. x = 0.56.

Etymology. A latinized adjective, from classical Greek: ενυδροβιος, meaning «living in water», an allusion to the larval habitat.

Distribution. Tanzania.

Biology. The puparia were collected in association with larvae of Simuliidae.

Relationships. Closely related to *D. gibbinsi*, but differing in the shape of the carina and in the male terminalia.

Comments. The female paratype has been associated because of the shape of the carina.

Drosophila hydroessa n. sp.

(Fig. 2)

Diagnosis. Carina broad, slightly triangular, dorsally flat; 9 prensisetae; paraphysis spheroid, densely covered with microtrichia.

Material examined. Holotype ♂: Tanzania - Dodwe river Amani 15.07.1981 (Coll. Raybould) / microvial / Drosophila s. str. hydroessa n. sp. Holotype L. Tsacas det. 2003 / Drosophila hydroessa n. sp. Bächli & Tsacas det. / HOLOTYPE.

Type locality. Dodwe River, near Amani, Tanzania.

Description. ♂.

Head. Frons generally microtrichose, with about 10 fine, scattered interfrontal setulae; frontal length about 0.29 mm; frontal index = 0.68, top to bottom width ratio = 1.16. Frontal triangle not clearly defined but apparently pointed anteriorly; ocellar triangle prominent, about 53 % of frontal length. Orbital plates anteriorly

hydroessa

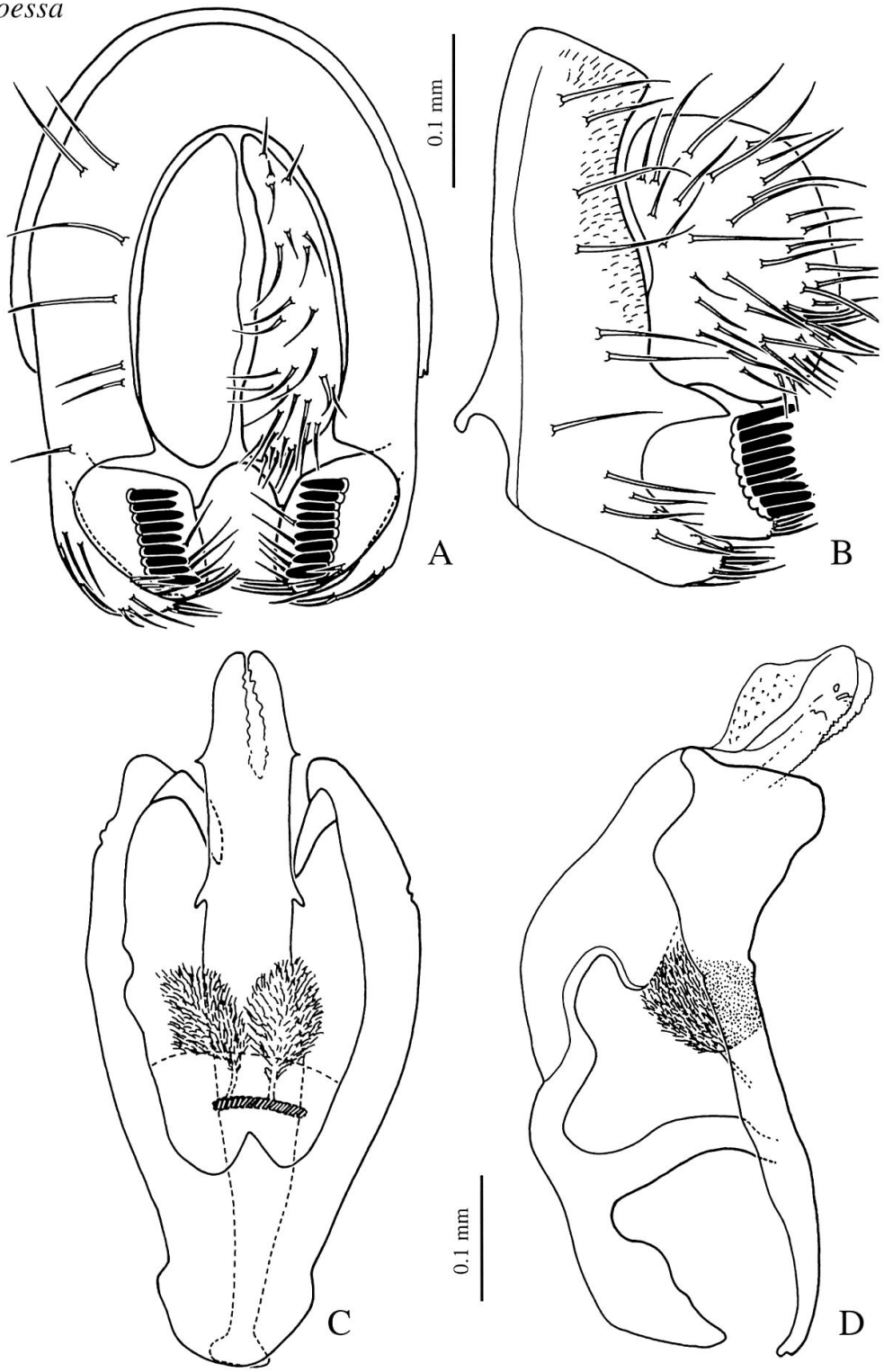


Fig. 2. *Drosophila hydroessa* n. sp., holotype male: A, Epandrium, cerci and surstyli+decasternum, posterior view. B, idem, left lateral view. C, hypandrium, aedeagus+aedeagal apodeme and paraphyses, posterior view. D, idem, left lateral view.

divergent from eye margin, shining, broadened in anterior half, distinctly narrowed behind, about 82 % of frontal length. Mid orbital seta fine, placed close behind and slightly outside of anterior one, distance of or3 to or1 = 60 % of or3 to vtm; postvertical setae strong, crossed, about 75%, ocellar setae about 100% of frontal length. One vibrissa, followed by 3 fine oral setae and 2 genal setae which are stronger than the vibrissa. Carina narrow between pedicels, broadened downwards, nose-like, dorsally flat in lower half. Cheek index about 4. Eye index about 1.15. Flagellomere 1 slightly longer than pedicel, length to width ratio about 1.4. Arista with 4 very short upper and 2 lower branches. Palpus relatively broad, with about 8 marginal setae.

Thorax length 1.45 mm. 6 rows of acrostichal setae. h index = 1.25. Transverse distance of dorsocentral setae about 170 % of longitudinal distance, dc index = 0.70; 2 additional dorsocentral setae present before the anterior one, distinctly decreasing in length. Scutellum flat, paler than scutum, distance between apical scutellar setae about 70 % of that of apical to basal one, basal ones convergent, apical ones crossed, tips almost at the same level; scut index = 1.05; sterno index = 0,85. Haltere pale. Front tarsomere ratio about 1.1.

Wing hyaline. Indices: C = 2.9, ac = 2.2, hb = 1.0, 4C = 0.7, 4v = 1.5, 5x = 1.1, M = 0.4, prox. x = 0.6.

♂ Terminalia (Fig. 2). Epandrium longer than wide in posterior view, bearing about 10 longer setae, microtrichose along posterior margin, distinctly broadened ventrad, particularly above the insertion of the surstyli, with a triangular ventral lobe wich is covered at tip by a bush of short setae. Cerci broad, prominent, posteriorly roundish, covered with some 40 scattered setae which are more densely placed at lower tip. Surstylus bare, with a straight row of about 9 longish prensisetae and about 10 setae arranged along the inner margin and the caudo-ventral corner. Hypandrium ventrally broad, lateral arms long, dorsad regularly bent inwards, apical part distinctly curved inwards, dorsal arch absent, gonopods indistinct (probably membraneous). Aedeagus laterally compressed, ventrally expanded medially, with 2 apical lobes which are finely denticulate along ventral margin and bearing a few short, dorsal spines subapically. Aedeagal apodeme narrow, length about 1/3 of the aedeagus. Paraphyses spherical, densely covered with short microtrichia and with a short, thin stem.

Etymology. A latinized female adjective, from classical Greek: υδροεσσα, meaning «living in water», an allusion to the larval biotope.

Distribution. Tanzania.

Biology. The puparia were collected in association with larvae of Simuliidae.

Relationships. Closely related to *D. simulivora*, but differing in the shape of the male terminalia.

Comments. Several specimens collected together with the holotype may belong to this species, but their condition does not enable a positive decision to be made (see below).

Additional species

Besides the specimens identified as *D. enhydrobia* n. sp. and *D. hydroessa* n. sp., the following specimens were collected in the area where the two new species were found:

D. gibbinsi Aubertin:

1 ♀, labelled: Tanzania - Dodwe river Amani 15.07.1981 (Coll. Raybould) / Drosophila s. str. gibbinsi Aubertin L. Tsacas det. 2003 / Drosophila gibbinsi Aubertin, Bächli & Tsacas det.
1 ♂ with puparium, labelled: Tanzania - Dodwe river Amani 15.07.1975 (Coll. Raybould) / 6. associated pupa & adult Dodwe S. 10/5/[19]75 emerged 16.5.[19]75 / microvial / Drosophila gibbinsi Aubertin, Bächli & Tsacas det.
1 ♂, labelled: Tanzania - Dodwe river Amani 15.07.1975 (Coll. Raybould) / 9. adult wild caught Dodwe S. 10/5/75 emerged Amani 16.5.[19]75 / microvial / Drosophila gibbinsi Aubertin, Bächli & Tsacas det.
1 ♂ with puparium. labelled: Tanzania - Zigi river Kwamkoro - nr. Amani 15.05.1975–17.05.1975 (Coll. Raybould) / microvial / Drosophila gibbinsi Aubertin, Bächli & Tsacas det.
1 ♂, labelled: Tanzania - Zigi river Kwamkoro - nr. Amani 15.05.1975–17.05.1975 (Coll. Raybould) / 8. adults Zigi R. Kwamikoro nr Amani, 17/5/[19]75 / collected 12/5/[19]75 Kwamkoro emerged 17/5/[19]75 18/5/[19]75 19/5/[19]75 / Drosophila gibbinsi Aubertin, Bächli & Tsacas det.

Distribution. Uganda, Tanzania (new record).

Comment. Because of their poor condition and/or the problem of associating males and females, no final decision was taken regarding the specific identity of the following specimens:

Drosophila sp. cf. *hydroessa* n. sp.:

1 ♂, labelled: Tanzania - Dodwe river Amani 15.07.1981 (Coll. Raybould) / microvial / Drosophila sp. cf. hydroessa, Bächli & Tsacas det.
1 ♂, labelled: Tanzania - Dodwe river Amani 15.07.1981 (Coll. Raybould) / microvial / Drosophila sp. cf. hydroessa, Bächli & Tsacas det.
1 ♂, labelled: Tanzania - Dodwe river Amani 15.07.1975 (Coll. Raybould) / microvial / Drosophila sp. cf. hydroessa, Bächli & Tsacas det.
2 ♀♀, labelled: Tanzania - Dodwe river Amani 15.07.1975 (Coll. Raybould) / Drosophila sp. cf. hydroessa, Bächli & Tsacas det.
2 ♀♀, labelled: Tanzania - Dodwe river Amani 15.07.1981 (Coll. Raybould) / Drosophila sp. cf. hydroessa, Bächli & Tsacas det.

Drosophila sp. cf. *gibbinsi* Aubertin:

2 ♂♂, labelled: card mount with puparium / Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
2 ♀♀, labelled: card mount with puparium / Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
5 ♀♀, labelled: card mount with puparium / Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♀, labelled: Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♀, labelled: card mount with puparium / Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / microvial / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♀ with puparium, labelled: Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♂, labelled: card mount with puparium / Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / microvial / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♂, labelled: Tanzania - Dodwe river Amani 15.07.1975 (Coll. Raybould) / microvial / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♂, labelled: Zigi R. Kwaikoro nr. Amani 16/6/[19]75 rec. J.N. Raybould / microvial / Drosophila s. str. gibbinsi Aubertin L. Tsacas det. 2003 / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
4 ♀♀, labelled: Tanzania - Zigi river Kwamkoro - nr. Amani 15.05.1975–17.05.1975 (Coll. Raybould) / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.
1 ♀, labelled: Tanzania - Zigi river Kwamkoro - nr. Amani 15.05.1975–17.05.1975 (Coll. Raybould) / microvial / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.

card mount with 3 puparia, labelled: Tanzania - Zigi river Kwamkoro - nr. Amani 15.05.1975–17.05.1975 (Coll. Raybould) / Drosophila sp. cf. gibbinsi A., Bächli & Tsacas det.

GEOGRAPHICAL DISTRIBUTION.

As shown by Tsacas & Disney (1974), the species of the *simulivora* group have been reported from West Africa (Liberia) to East Africa (Uganda), but also in South Africa (Natal) and Madagascar. The two new species as well as the undescribed specimens close to *D. hydroessa* n. sp. and *D. gibbinsi*, respectively, are recorded from Tanzania. We can only suppose that many additional undescribed species will be found in the extensive river systems of Africa, once these habitats are adequately explored.

ACKNOWLEDGEMENTS

We want to thank John R. Raybould (Bristol, U.K.) for this interesting and important collection of *Drosophila*, Carlos R. Vilela (São Paulo, Brazil) for his comments on an earlier version of the manuscript, and Adrian C. Pont (Oxford, U.K.) for arranging the loan of these specimens as well as for checking the English of the manuscript.

ZUSAMMENFASSUNG

Die in die *Drosophila simulivora*-Gruppe gehörenden neuen Arten *D. enhydrobia* und *D. hydroessa* werden beschrieben. Deren Larven leben räuberisch von Eiern und Larven von Simuliiden in Tanzania.

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