



The presence of *Homoeoneuria* s.s. (Ephemeroptera: Oligoneuriidae) in South America with the description of a new species

F.F. SALLES¹, C.N. FRANCISCHETTI² & E.D.G. SOARES³

¹Depto. de Ciências da Saúde, Biológicas e Agrárias, Centro Universitário Norte do Espírito Santo, Universidade Federal do Espírito Santo, CEP 29.933-415, São Mateus, ES, Brazil. E-mail: ffsalles@gmail.com

²Programa de Pós-Graduação em Entomologia, Laboratório de Ecologia de Comunidades, Depto. de Biologia Geral, Universidade Federal de Viçosa, CEP 36.570-000, Viçosa, MG, Brazil. E-mail: cnfrancischetti@gmail.com

³Depto. de Ciências da Saúde, Biológicas e Agrárias, Centro Universitário Norte do Espírito Santo, Universidade Federal do Espírito Santo, CEP 29.933-415, São Mateus, ES, Brazil. E-mail: elainedgs@yahoo.com.br

Abstract

In the present work a new species of *Homoeoneuria* is described based on nymphs and adults from Southeastern Brazil. Based on cladistics, the new species belongs to the subgenus *Homoeoneuria*s.s. *Homoeoneuria* (*H.*) *watu* sp. n., besides being the second species of the genus reported from South America, is the first representative of the subgenus from the region. The new species can be distinguished from the other described species of the genus by the following combination of characters: In the adult stage, (1) pronotum with prominent posteromedian pale yellow spot almost reaching anterior margin; (2) abdominal color pattern; (3) shape of penes. In the nymph, (1) head heavily washed with brownish-orange between compound eyes and ocelli; (2) antennal pedicels with short, thick setae; (3) small paired tubercles present on vertex and anterior margin of pronotum; (4) galea-lacinia of maxillae with submarginal row of 20–21 long, spinous setae; (5) abdominal color pattern. Comments on the biology of the new species are also provided.

Key words: Taxonomy, Neotropics, cladistics, new records

Introduction

The mayfly genus *Homoeoneuria* Eaton (Ephemeroptera: Oligoneuriidae) consists of the following species and subgenera: *H.* (*Homoeoneuria*) *ammophila* (Spieth), *H.* (*H.*) *dolani* Edmunds, Berner & Traver, *H.* (*H.*) *salviniae* Eaton, *H.* (*H.*) *alleni* Pescador & Peters, *H.* (*H.*) *cahabensis* Pescador & Peters, and *H.* (*Notochora*) *fittkawi* Pescador & Peters. Except for *H.* (*H.*) *salviniae*, recorded from Central America, all species of *Homoeoneuria* s.s. are recorded from North America, whereas *H.* (*N.*) *fittkawi* is the only species known until now from South America (Northern Brazil) (Pescador & Peters 1980, Da-Silva 1992).

In the present work a new species of *Homoeoneuria* is described based on nymphs and adults from Minas Gerais State, Southeastern Brazil. In order to infer the systematic position of the new species, a cladistic analysis was performed. Comments on the biology of the new species are also provided.

Material and methods

Collected specimens were preserved in 80% ethanol. Body parts of nymphs and adults were mounted on microscope slides in Euparal® and drawn with the aid of a camera lucida attached to a stereomicroscope. Digital photographs were taken with a Camera DP 70 attached to a stereomicroscope Olympus SZX 12 (up to 144x), and edited using Image-Pro Plus®. The analysis of the particle size of the sand bottom river sample

was made following EMBRAPA (1997). Nymphal behavior was observed in the laboratory.

Material deposition is abbreviated as follows: Coleção de Invertebrados do Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil (INPA), Coleção Entomológica da Universidade Federal do Espírito Santo, Vitória, Espírito Santo, Brazil (UFES).

Cladistic analysis included the known species of *Homoeoneuria*, and *Oligoneurioides amazonicus* Demoulin which was chosen as outgroup to root the tree. *Homoeoneuria* was considered *a priori* as monophyletic because this genus presents several exclusive characters. To build the data matrix (Table 1) the character set of Pescador & Peters (1980) was reevaluated and new characters were added. The male imago of *H. salviniae*, and male and female imagos of *H. alleni* are unknown. All characters were treated as unordered, including six autapomorphies. The cladistic analysis was performed using NONA version 2.0 (Goloboff 1993), with the interface WINCLADA 0.9.9 beta (Nixon 1999), using 500 replications with five starting trees each. The Bremer support was carried out in TNT version 1.1 (Goloboff et al. 2000). The discussion was based on unambiguous characters (Fig. 14). The notation (character [state]) was used in the character citations in the results and discussion text.

Results

Homoeoneuria (Homoeoneuria) watu sp. n.

(Figs. 1–13)

Male imago (in alcohol) (Figs. 1–2)

Body length: 8.0–8.4 mm. Forewings length: 7.9–8.1 mm. Caudal filaments length: 3.1–3.3 mm.

Head (Fig. 1). General coloration dark brown. Antennae dark brown. Basal half of lateral ocelli brown, remainder and median ocellus transparent white. Eyes grayish-black.

Thorax (Fig. 1). General coloration dark brown, membranous areas pale yellow. Pronotum with prominent posteromedian pale yellow spot almost reaching anterior margin. Wings (Fig. 1): membrane of forewings iridescent blue, veins brownish. Legs: coxae and trochanter of foreleg dark brown, of mid and hind legs blackish; femora, tibiae, and tarsi of foreleg slightly washed with brown; remainder of mid and hind legs whitish.

Abdomen. Terga blackish, with black markings (Fig. 1). Sterna lighter than terga, with whitish markings, and with median longitudinal pale band. Intersegmental membranae yellowish on terga, whitish on sterna. Genitalia (Fig. 2): penis dark brown. Caudal filaments orange, setae black.

Female imago (in alcohol)

Body length: 8.7 mm. Forewings length: 8.8 mm. Caudal filaments length: broken-off and lost.

Similar to male imago, except for absence of markings on abdominal sterna.

Mature nymph (in alcohol). (Figs 3–13)

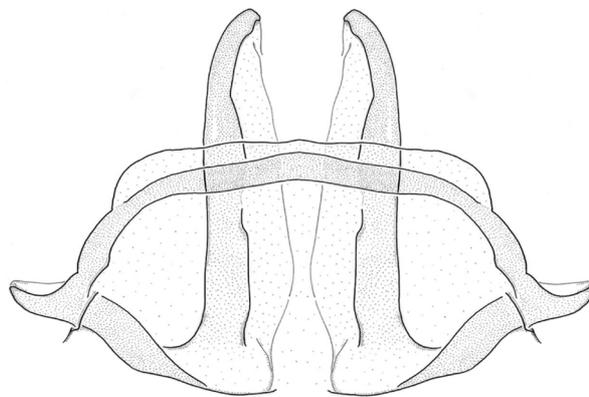
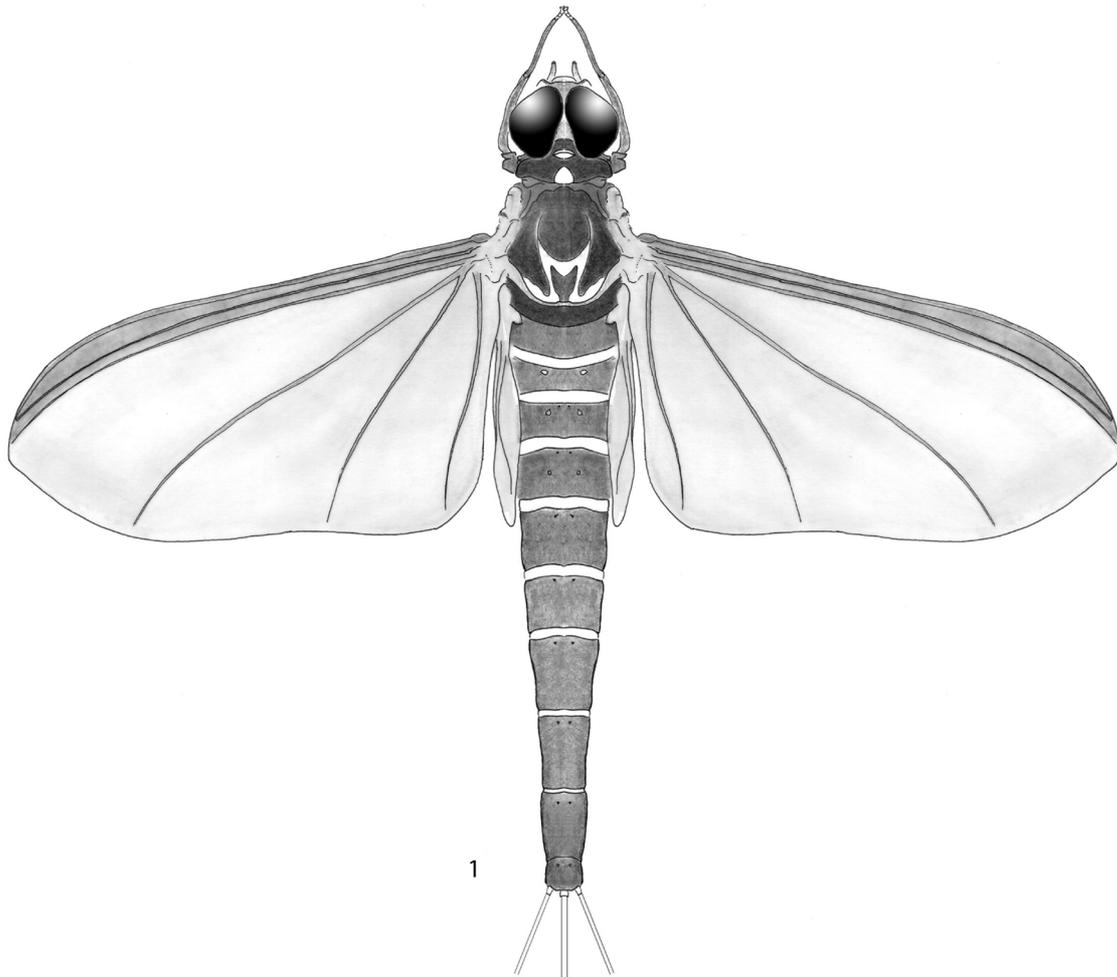
Body length: 8.5–9.0 mm. Caudal filaments length: 3.4–3.7 mm.

Head (Figs. 3, 11–12). General coloration yellowish washed with brown, heavily washed with brownish-orange between compound eyes and ocelli; ocelli white. Eyes brownish-black. Vertex with pair of small median tubercles. Antennae pale yellow; pedicel with short, thick setae (Fig. 4). Mouthparts: galea-lacinia of maxillae with submarginal row of 20–21 long, spinous setae (Fig. 5); posterior margin of superlingua strongly curved (Fig. 6); segment 1 of labial palpi approximately 3/4 length of segment 2.

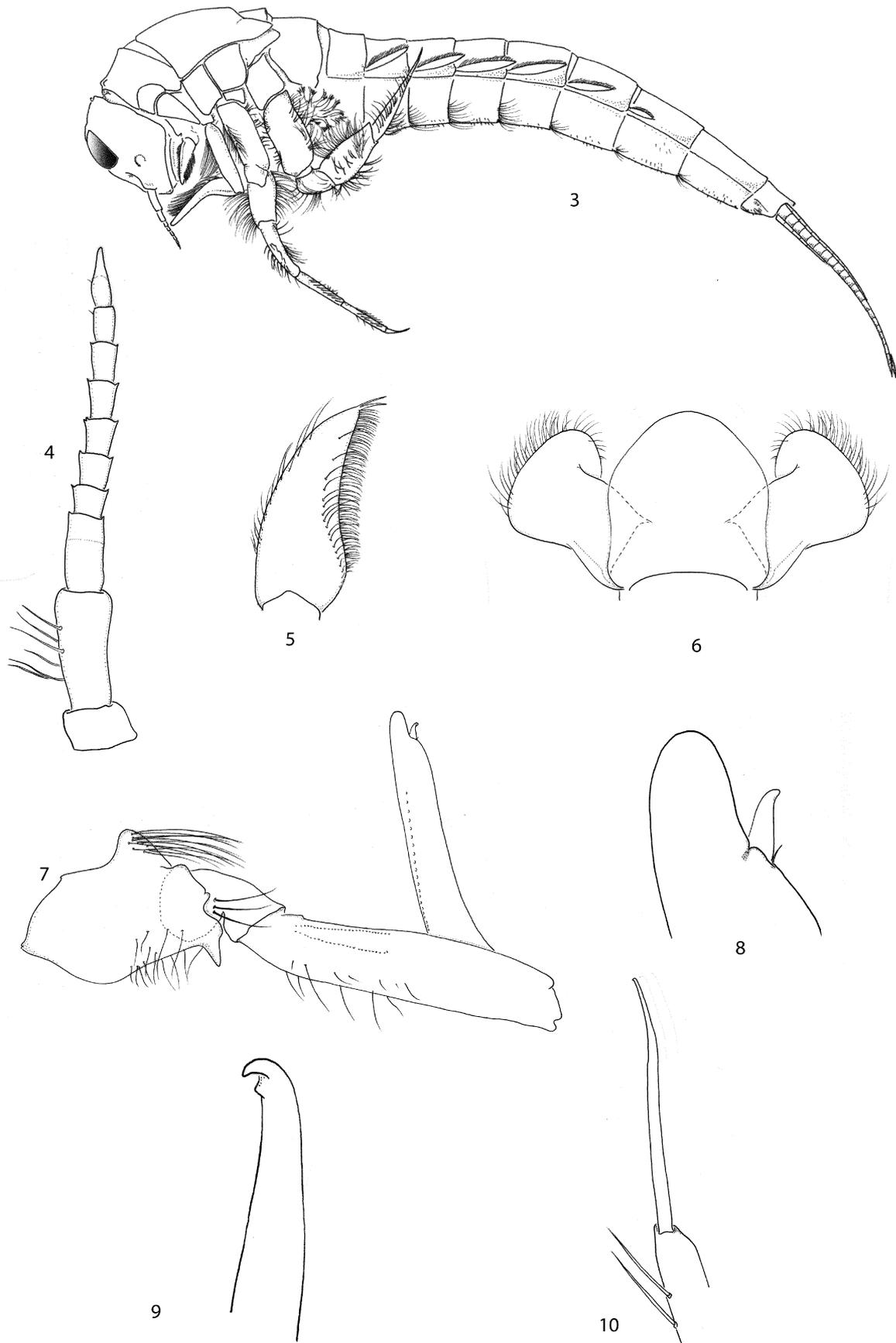
Thorax. Pronotum pale yellow washed with brown, with orange marks; anterior margin with pair of small tubercles (Figs. 3 and 12). Mesonotum pale yellow with large, median, whitish spot followed by an orange, median, longitudinal stripe. Metanotum orange. Legs whitish. Foreleg (Figs. 7, 8 and 12): coxae tinged with orange; tibiae strongly bowed, maximum width approximately 3/5 maximum width of femora; distance of tarsi from apex of tibiae approximately 3/4 maximum width of tibiae; apical portion of tibiae straight. Middle leg (Fig. 9): tarsal claws approximately 1/3 length of tarsi and 1/2 length of tarsal claws of hind legs. Hind leg

(Fig. 10): tarsal claws $2/5$ length of tarsi.

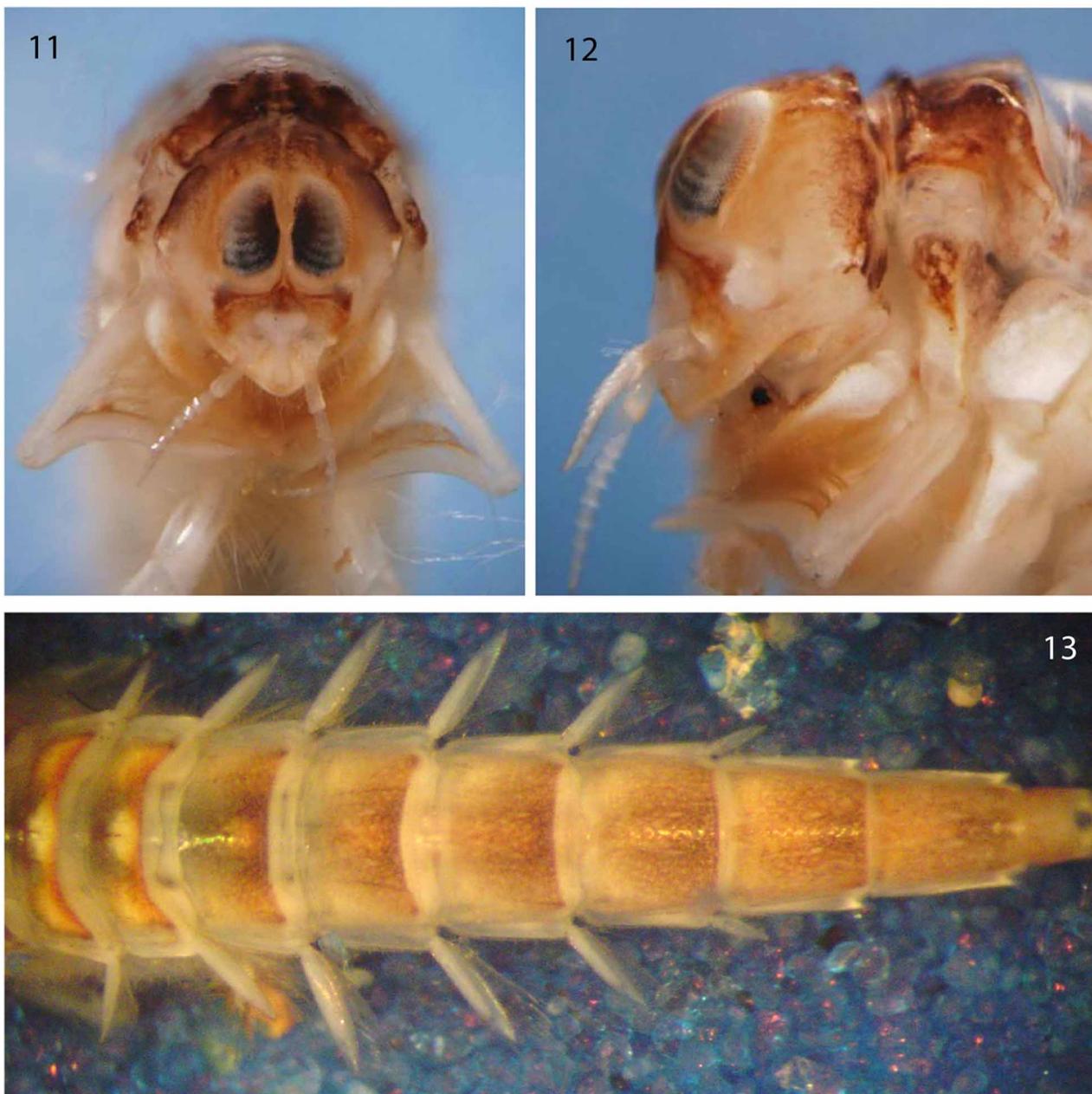
Abdomen (Fig. 13). Terga 1–3 yellowish-white washed with orange; posterior half of terga 1 and anterior margin of terga 2 and 3 hyaline; terga 4–9 whitish washed with orange and with dark grey markings near posterior margins (depending on the specimens, these markings can be more widespread); terga 10 whitish, slightly washed with orange and with two white markings near posterior margins. Sterna whitish. Caudal filaments pale yellow, setae pale yellow, except for a tuft of black setae on apical $2/3$.



FIGURES 1–2. *Homoeoneuria (H.) watu* sp. n., adult. **1**, Habitus of male imago; **2**, male genitalia.



FIGURES 3–10. *Homoeoneuria (H.) watu* sp. n., nymph. **3**, lateral view of nymph; **4**, Antenna. **5**, Galea-lacinia. **6**, Hypopharynx. **7**, Fore leg (long and pectinated setae on inner margin of femur and tibia omitted). **8**, Detail of apex of fore leg. **9**, Detail of mid tarsal claw. **10**, Detail of hind tarsal claw.



FIGURES 11–13. *Homoeoneuria (H.) watu* sp. n., nymph. **11**, Head (frontal view); **12**, Head (lateral view); **13**, Abdomen (dorsal view).

Type material. Holotype: male imago, Minas Gerais, Parque Estadual do Rio Doce, Rio Belém (19° 35' 076" S; 42° 33' 980" W, 257m), 25/x/2005, C.N. Francischetti, F.F. Salles, leg (UFES). Paratypes: three male imagos, one female imago, ten nymphs, same data as holotype (one male imago, one female imago and five nymphs at UFES; remainder at INPA).

Etymology: Watu, how the Krénak people, a small indigenous group who still inhabits the region, call the Doce River. The epithet is an allusion to the Rio Doce State Park, where the new species was exclusively found.

Diagnosis. *Homoeoneuria (H.) watu* sp.n. can be distinguished from the other described species of the genus by the following combination of characters: In the adult stage, (1) pronotum with prominent posteromedian pale yellow spot almost reaching anterior margin; (2) abdominal color pattern; (3) shape of penes (Fig. 2). In the nymph, (1) head heavily washed with brownish-orange between compound eyes and

ocelli (Fig. 11); (2) antennal pedicels with short, thick setae (Fig. 4); (3) small paired tubercles present on vertex of head and anterior margin of pronotum (Figs. 3 and 12); (4) galea-lacinia of maxillae with submarginal row of 20–21 long, spinous setae (Fig. 5); (5) abdominal color pattern (Fig. 13).

Phylogeny

Character list

Thirteen nymphal and six adults characters were selected (data matrix in Table 1), including six autapomorphic characters. From these, the characters 4, 5, 6, 7, 10, 11, 12, 13, 14, and 17 are new; and 1, 2, 3, 8, 9, 15/16 (contingent characters), 18, 19 were represented in Pescador & Peters (1980) work, in which all characters were binary and ordered. Herein all characters are considered as unordered and some of the Pescador & Peters (1980) characters were split in more states (as indicated for each case). The individual character consistency index is also provided.

1. Antennal pedicel (CI= 33): (0) glabrous; (1) with short, thick setae.
2. Number of spinous setae of submarginal row on galea-lacinia (CI= 50): (0) more than 15; (1) less than 15.
3. Posterior margin of superlingua (CI=100): (0) strongly curved; (1) slightly curved.
4. Relative length of labial palp segment I/II (CI=33): (0) shorter than 0.6; (1) longer than 0.7
5. Paired small tubercles on head and pronotum (autapomorphy): (0) absent; (1) present.
6. Spot on fore coxae (CI= 50): (0) absent; (1) present.
7. Shape of fore tibiae (CI=100): (0) moderately bowed; (1) strongly bowed.
8. Fore tibia width/ fore femora width (CI=100): (1) < 0.75 ; (0) > 0.8 .
9. Distance of fore tarsi from apex of tibiae relative to width of tibiae (CI=66): (0) > 0.7 ; (1) $> 0.5 < 0.6$; (2) < 0.2 . The size classes considered as states of character herein constitute reinterpretations of the states of this character presented by Pescador & Peters (1980), as follows: state (0), in this paper, accords partially to the "primitive state" of Pescador & Peters (1980); state (2) regards partially to the "derived state" of Pescador & Peters (1980); and the state (1) refers to the highest and the lowest value of the states "primitive" and "derived" of Pescador & Peters (1980), respectively, constituting an intermediary state. We think that these changes are necessary to make the size classes more reliable, since in Pescador & Peters (1980) interpretation, the amplitude of the values of the states "primitive" and "derived" were almost overlapping.
10. Apical portion of fore tibiae (autapomorphy): (0) slightly downward to straight; (1) curved upward.
11. Length of mid tarsal claw related to length of mid tarsi (CI=66): (1) < 0.28 ; (0) $> 0.3 < 0.5$; (2) > 0.5 .
12. Length of hind tarsal claw related to length of hind tarsi (CI=100): (0) : < 0.4 ; (1) < 0.9 ; (2) similar in length (> 0.95).
13. Denticles on mid tarsal claws (CI=50): (1) absent; (0) present.
14. Abdominal coloration (CI=100): (0) complex; (1) broad markings on posterior margin; (2) posterolateral spots; (3) narrow markings on posterior margin.
15. Styliger bar (autapomorphy): (0) absent; (1) present.
16. Styliger bar development (autapomorphy): (0) weakly developed; (1) well developed.
17. Penial arms (CI=100): (0) absent; (1) present.
18. Penial process (autapomorphy): (0) absent; (1) present.
19. Shape of emargination on female sternum 7 (autapomorphy): (0) shallow and broad; (1) deep and narrow.

Cladistic analysis

The parsimony analysis resulted in one cladogram, 33 steps length, consistency index 72 (66 without autapomorphic characters) and retention index 60 (Fig. 14, including Bremer support).

Biology

Homoeoneuria (H.) watu sp. n. was collected in an area of the Belém River, with pristine native forest inside the Rio Doce State Park. The nymphs were observed inhabiting the sand shifting bottom of the river, similar mesohabitat described by Pescador & Peters (1980) for another species of the genus. The particle size analysis of the sand bottom river sample shows that the substratum where the new species was found was composed by 96 percent of coarse sand. Despite extensive collections in several other mesohabitats along the river, no nymphs of the new species were found. The nymphs burrow rapidly into the sand using vibration movements of the abdomen helped by the legs and live just below the surface. The nymphs make gill movements and we assumed that it could be used for improving the respiration process, or for filtering food from the water in the interstices of the sand, using the long and pectinate setae present on their forelegs.

The imagos were collected at midday, between 11:00 AM and 12:00 PM which is similar to the observations by Pescador & Peters (1980) for another species of the genus. The imagos observed during the field trip were flying rapidly about 50 centimeters above the water surface. The males flew considerably faster than the only female observed.

Despite extensive collections in several other rivers of the region, including those with shifting sand bottom as the Belém River, as well as other places at the Belém River, no nymphs of the new species were found. Therefore, this fact suggested that *H. (H.) watu* sp. n. could be an important biological indicator for that pristine area, but further studies about the biology of the species would be necessary to corroborate our hypothesis.

Acknowledgments

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