

Two new Hebridae (Insecta: Hemiptera: Heteroptera) from Madhya Pradesh, India, with a discussion on *Neotimasius*

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Abstract

Hitherto, *Neotimasius* ANDERSEN, 1981 has been a monotypic genus with the type species *N. orientalis* ANDERSEN, 1981 from southern India. In this study, *Neotimasius bruckneri* sp.n. from Madhya Pradesh, central India, is described, and the first record of *N. orientalis* from Kerala is documented. *Timasius fenestratus* sp.n. from Madhya Pradesh cannot be assigned to any of the known species groups of *Timasius*, but shares the important character of “transparent cells” on the ventral carinae with species of *Neotimasius*. In the light of these new findings, the status of *Neotimasius* as a valid genus is discussed.

Key words: Gerromorpha, Hebridae, velvet water bugs, phylogeny, taxonomy, morphology, new species.

Zusammenfassung

Neotimasius ANDERSEN, 1981 ist bisher eine monotypische Gattung gewesen, mit der Typusart *N. orientalis* ANDERSEN, 1981 aus dem südlichen Indien. In dieser Arbeit wird *Neotimasius bruckneri* sp.n. aus Madhya Pradesh im zentralen Indien vorgestellt und ein Erstnachweis von *N. orientalis* aus Kerala erbracht. Ebenfalls aus Madhya Pradesh wird *Timasius fenestratus* sp.n. beschrieben, welcher keiner der bisher bekannten Artengruppen von *Timasius* zugeordnet werden kann und das Merkmal der „transparenten Zellen“ auf den Ventralkielen – in kleinerer Form – mit den Arten der Gattung *Neotimasius* teilt. Im Licht der neuen Erkenntnisse wird der Status von *Neotimasius* als valides Genus diskutiert.

Introduction

It can be concluded from collections housed in various European museums that the Indian Hebridae fauna must be very rich. The 23 species described from India (by DISTANT 1909, 1910, PAIVA 1919, ANDERSEN 1981, ZETTEL 1998, 2000, 2003, 2012) represent only a small fraction of the country's species diversity. A recent check list for India has been published by THIRUMALAI (2002). Concerning the water bug fauna of Madhya Pradesh, 25 species of Gerromorpha have been recorded in this state (see THIRUMALAI & al. 2007, CHANDRA & JEAMALAR 2011, CHANDRA & al., in press) including a single species of Hebridae. However the identification of *Hebrus orientalis* DISTANT, 1903 remains doubtful (discussed in THIRUMALAI & al. 2007).

The present study adds two new species of the genera *Timasius* DISTANT, 1909 and *Neotimasius* ANDERSEN, 1981. Species of both taxa are ripicolous, with a preference for wet rock faces along rivers and streams (ANDERSEN 1981; observations on *Timasius* by the author). *Timasius* comprises 39 described species (including the new one) and has an Oriental distribution from Sri Lanka and the southern tip of India throughout southern and southeastern Asia eastwards to Taiwan, Borneo, and Java (CHEN & al. 2005, ZETTEL

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2012). In contrast, *Neotimasius* has been known only from its type species, *N. orientalis* ANDERSEN, 1981 from Karnataka (ANDERSEN 1981) and Tamil Nadu (ZETTEL 2000); a second species is added here.

Material and methods

Specimens are dry-mounted, glued on cardboard. Genitalia of males have been dissected and glued together with specimens. Material is referred to by citing the original labels, which are marked with “”; the backslash sign \ indicates the break of a line. Descriptions of new species primarily were made using a Nikon SMZ800 binocular microscope. Terminology follows ANDERSEN (1981) and ZETTEL (2011).

Acronyms for measurements and indices (from ZETTEL 2011):

- A₂L Maximum length of antennomere 2 (in mm)
- AbI Abdomen index (referring to length of abdomen). Length of abdomen (measured dorsally from level of apex of metanotal elevation to apex of abdomen) : $PL \times 100$
- AnI Antenna index (referring to antennal length). Length of antenna (composed length of antennomeres) $BL \times 100$
- AtI Antennal tubercle index (referring to lateral protrusion of tubercles). Maximum distance of lateral margin of antennal tubercles $HW \times 100$
- AW Maximum width of abdomen (in mm)
- BL Body length. Total length of specimen, measured in dorsal aspect (in mm)
- EI Eye width index (referring to eye size). Maximum width of eye in % of interocular distance (ID). For higher accuracy, eye width index is calculated by the formula $EI = 100 \times (HW - ID) / 2 ID$. HW and ID measured in exact dorsal aspect of head.
- HI Head index. $HL : HW \times 100$
- HL Median head length, measured dorsally along midline in perpendicular view to apex and posterior margin of head in same plane (in mm)
- HW Maximum head width across eyes (including eyes; in mm)
- MMI Mesoscutellum-metanotal elevation index* (referring to size of metanotal elevation). Maximum combined length of mesoscutellum + metanotal elevation $PL \times 100$
- MtI Metatibia index* (referring to length of legs). $MtL : PW \times 100$
- MtL Maximum metatibia length (in mm)
- PHI Pronotum-head index*. $PW : HW \times 100$
- PnI Pronotum index* (referring to shape of pronotum). $PW : PL \times 100$
- PL Median length of pronotum including pronotal lobe (in mm)
- PW Maximum width of pronotum including pronotal lobe* (in mm)

* Note that these indices vary with wing polymorphism.

Illustrations: Stacked digital images (Figs. 1–3) were taken with a Leica DFC 490 camera attached to a Leica MZ16 binocular microscope and processed with the help of Leica Application Suite. They were then stacked with ZereneStacker 64-bit and processed with Adobe Photoshop 7.0. Line drawings of heads and metanotal elevations were prepared with the help of a camera lucida fixed to a Nikon SMZ 1500 microscope. Line drawings of the genital structures were made with an Olympus BX40 microscope with a camera lucida at magnification of 400 \times .

Taxonomy

Neotimasius bruckneri sp.n. (Figs. 1, 4–8)

Etymology: Named for my colleague Harald Bruckner on the occasion of obtaining his master degree in biology.

Type material: Holotype (macropterous female; NHMW Inv.No. 9304) labelled “INDIA: (MP6) southern\ Madhya Pradesh\ Hoshangabad Dist., Panar\ Pani [stream], 26.,27.II.2008\ leg. M.Jäch, S&P Sharma”, “ca. 30 km S Piparia\ ca. 5 km NNE Pachmarhi\ Matkuli – Pachmarhi road\ ca. 850 m\ 22°30'25"N/78°26'43"E”

Type locality and habitat: India, Madhya Pradesh, Hoshangabad District, ca. 30 km south of Piparia, and ca. 5 km northnortheast of Pachmarhi, N 22°30'25" E 78°26'43", ca. 850 m a.s.l. The collection site is located at the road between Matkuli and Pachmarhi. During sampling, the stream Panar Pani was ca. 3–5 m wide and with gravelly and rocky substrate; its surrounding was forested (M.A. Jäch, pers. comm.).

Diagnosis: Typical species of *Neotimasius*, relatively small (body length 2.7 mm), with small abdomen (Fig. 1), strongly reduced ventral buccula tooth (Fig. 5), and high ventral thoracic carinae (Fig. 8).

Description of macropterous female:

Measurements: BL 2.70 mm, HL 0.64 mm, HW 0.48 mm, A₂L 0.62 mm, PL 0.61 mm, PW 1.11 mm, MtL 1.06 mm, AW 1.06 mm. Indices: HI 135, AtI 77, EI 64, PHI 229, PnI 182, MMI 78, MtI 97, AbI 215. Relative lengths of antennomeres 1–3 (in % of antennomere 2; antennomere 4 broken off): 126 100 137. Relative lengths of leg segments (in % of metatibia): profemur 57, protibia 60, protarsus 24, mesofemur 63, mesotibia 64, mesotarsus 24, metafemur 81, metatibia 100, metatarsus 31.

Colour (Fig. 1): Dark brown to blackish. Buccula pale yellow. Posterior margin of pronotum, mesoscutellum, pro- and mesacetabula light to medium brown. Posterolateral margin of prothorax yellowish brown. Each cell of forewing with indistinct frosted mark in basal half; membrane with four indistinct grayish marks. Antennae brown, first antennomere basally yellowish. Legs yellow at bases, apices of femora, entire tibiae and tarsi dark brown.

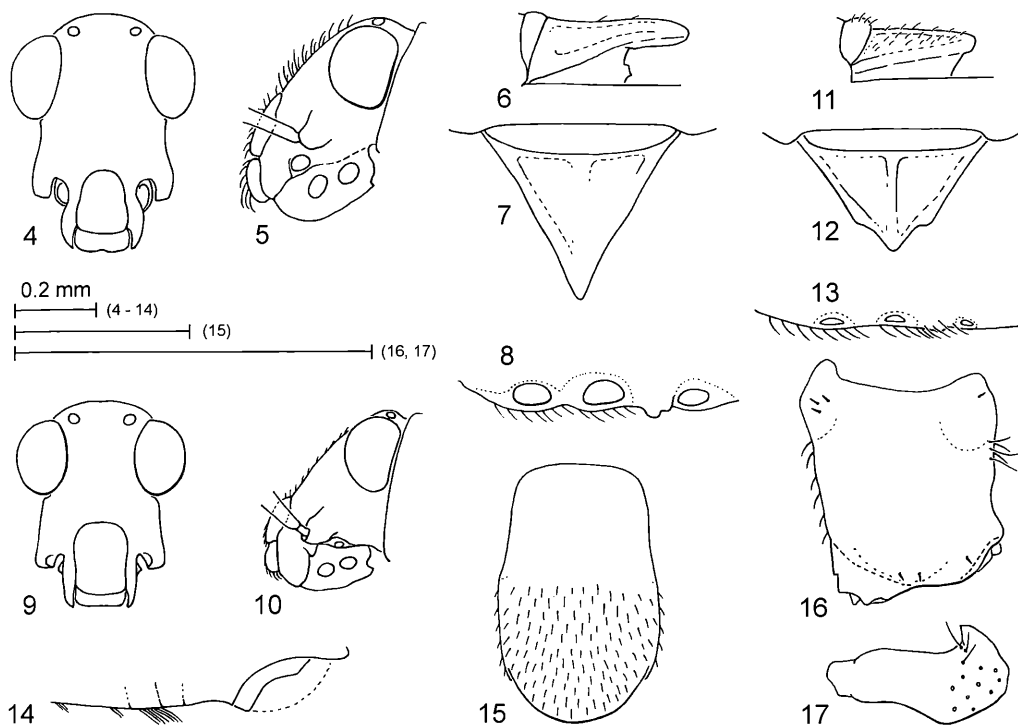
Pilosity: Dorsum of head and thorax, and corium veins with very sparse, thin, golden, subcumbent setae. Head, in addition to golden setae with short, erect, black setae dorsally. Venter of body with thin, subcumbent, grayish pilosity.

Structures: Body elongated, with moderately long antennae and legs. Head (Fig. 4) long, sides between anterior margin of eyes to large, rounded antennal tubercles distinctly



Figs. 1–3: Habitus, dorsal aspect, of (1) *Neotimasius bruckneri* sp.n. (holotype, female, NHMW-Hemiptera Inv.No. 9304); (2) *Neotimasius orientalis* (male, NHMW-Hemiptera Inv.No. 5735); (3) *Timasius fenestratus* sp.n. (holotype, male, NHMW-Hemiptera Inv.No. 9305).

divergent. Preocular tubercles absent. Anteclypeus slightly compressed, in lateral aspect hardly convex. Buccula (Fig. 5) high, with two large circular impressions, posteriorly almost rounded, ventral tooth strongly reduced to a minute denticle. Head between antennal tubercle and buccula with one additional large, circular impression (Fig. 5; also



Figs. 4–17: Morphological characteristics of new species: (4–8) *Neotimasius bruckneri* sp.n., (9–17) *Timasius fenestratus* sp.n.: (4, 9) Head, frontal aspect (pilosity omitted); (5, 10) head, lateral aspect (pilosity partly omitted); (6, 11) mesoscutellum and metanotal elevation, lateral aspect (pilosity partly omitted); (7, 12) mesoscutellum and metanotal elevation, dorsal aspect (pilosity omitted); (8, 13) left ventral carina with transparent cells, lateral aspect (dotted lines delimit yellow areas); (14) ventral outline of abdomen of male with prominent hair brush on sternum 5 (broken line: genitalia dissected); (15) pygophore, ventral aspect (dotted line delimits dark, pilose distal part); (16) proctiger, dorsal aspect; (17) left paramere, lateral aspect.

visible in frontal aspect of head, Fig. 4). Pronotum moderately wide, sides with rather shallow emargination; surface with numerous deep, comparatively small punctures. Metanotal elevation (Figs. 6, 7) very long and triangular in dorsal aspect, 1.1 times as wide as long, its free apex sharply pointed in dorsal aspect, finger-shaped in lateral aspect. Forewing posteriorly reaching apex of abdomen, laterally reaching connexival margins. Legs and abdomen without modifications.

Comparative notes: *Neotimasius bruckneri* sp.n. is very similar to *N. orientalis* and obviously most closely related to this species. However, there are differences in the proportions of the two species: The ration of body length width is 2.5 in *N. bruckneri* sp.n., but 2.7 in females of *N. orientalis* (compare also Figs. 1 and 2). The abdomen of *N. bruckneri* sp.n. is comparatively small, abdomen width is clearly smaller than pronotal width (0.95 times), whereas it is subequal in *N. orientalis* (0.98–1.00 times). Because of the shorter abdomen, the apex of the metanotal elevation lies nearly at mid-length to the body in *N. bruckneri* sp.n., but clearly in front of it in *N. orientalis*. The bucculae

of *N. bruckneri* sp.n. and *N. orientalis* are of similar shape, but the ventral posterior tooth is minute in *N. bruckneri* sp.n. and distinct in *N. orientalis* (although it is curved mesad and appears small in a strict lateral view of the head; cf. ANDERSEN 1981: fig. 88). The thoracic ventral carinae are slightly higher in *N. bruckneri* sp.n. (Fig. 8) than in *N. orientalis*, surpassing the mesocoxae ventrally in the first species, but not so in the latter. Body length of the holotype of *N. bruckneri* sp.n. (2.70 mm) is smaller than body length of *N. orientalis* (2.8 mm in female holotype from Karnataka according to ANDERSEN 1981; 2.90–2.92 mm in males from Kerala; 3.02–3.12 mm in males from Tamil Nadu).

Neotimasius orientalis ANDERSEN, 1981 (Fig. 2)

Additional material examined: 2 macropterous males (NHMW-Hemiptera Inv.No. 5735, 5736) labelled “S.INDIA, KERALA, Thekkady\ Periyar Lake, 09°34'N 77°10'E\ 900-1000m, 19.-27.IV.1997\ Dembicky & Pacholátko leg.”

Notes: *Neotimasius orientalis* was described from Karnataka (ANDERSEN 1981) and later recorded from Tamil Nadu (ZETTEL 2000). The two males, which were additionally examined, largely agree with both the original description (based on a female) and the males from Tamil Nadu. They represent the first record from Kerala.

Timasius fenestratus sp.n. (Figs. 3, 9–17)

Etymology: The Latin adjective “fenestratus” means “with window” and refers to the transparent cells on the ventral carinae.

Type material: Holotype (macropterous male; NHMW Inv.No. 9305) labelled “INDIA: (MP11) southern\ Madhya Pradesh\ Chhindwara Dist., Bhadhua\ Chora (stream), 28.II.2008\ leg. M.Jäch, S&P Sharma”, ca. 10 km E Matkuli\ near Mahul Jhir\ east of Jhirpa, 400 m\ 22°35'59"N/78°35'30"E" **Paratypes** (all macropterous): 1 male (NHMW Inv.No. 9306) labelled “INDIA: (MP13) southern\ Madhya Pradesh\ Hoshangabad Dist.\ River Denwa, 28.II.2008\ leg. M.Jäch, S&P Sharma”, “ca. 8 km SSE Matkuli\ Satpura Range\ ca. 400 m\ 22°34'29"N/78°29'43"E”; 3 females (NHMW Inv.No. 9307–9309) labelled “INDIA: (MP17) southwestern\ Madhya Pradesh,\ Indore Dist.\ Choral Nadi [river], 1.III.2008\ leg. M.Jäch, S&P Sharma”, “Indore–Barwah road, NW of\ Choral, ca. 20 km SSE Indore,\ Vindhya Range, 350 m\ 22°27'50"N/75°55'42"E”

Type locality and habitat: Madhya Pradesh, Chhindwara District, ca. 10 km east of Matkuli, east of Jhirpa, and near Mahul Jhir, N 22°35'59" E 78°35'30", ca. 400 m a.s.l. At the collection site during sampling, the Bhadhua Chora stream was ca. 2–5 m wide, with muddy and gravely substrate, and slowly flowing through cultivated land; its banks were partly covered with grass (M.A. Jäch, pers. comm.).

Further localities and habitats: Madhya Pradesh, Hoshangabad District, ca. 8 km southsoutheast of Matkuli, in the Satpura Mountain, N 22°34'29" E 78°29'43", ca. 400 m a.s.l. At the collection site, the Denwa River was ca. 10–50 m wide, with several furcations. It was flowing through forested and cultivated land; its substrate consisted of gravel and boulders, its margins had some sand and mud (M.A. Jäch, pers. comm.).

Madhya Pradesh, Indore District, ca. 20 km southsoutheast of Indore, in the Vindhya Mountain Range, at the road from Indore to Barwah, northwest of the village Choral (= Charal), N 22°27'50" E 75°55'42", ca. 350 m a.s.l. At the collection site, the Choral Nadi River was ca. 3–10 m wide and flowing through degraded forest; its substrate was heterogenous, consisting of gravel, sand, and mud (M.A. Jäch, pers. comm.).

Diagnosis: Species of *Timasius* with high buccula bearing two ovate impressions (Fig. 10), with short metanotal elevation bearing a pair of strong subapical projections (Fig. 12), and with ventral thoracic carinae each bearing three small, transparent impressions (Fig. 13). Male with conspicuous hair tuft on sternum 5 (Fig. 14), symmetrical genitalia except for the slightly asymmetrical, with subtrapezoidal proctiger (Fig. 16), and with small, hook-shaped parameres (Fig. 17).

Description of macropterous morph:

Measurements of holotype: BL 2.20 mm, HL 0.55 mm, HW 0.43 mm, A₂L 0.22 mm, PL 0.52 mm, PW 1.01 mm, MtL 0.83 mm, AW 0.93 mm. Indices: HI 130, AtI 77, EI 74, AnI 50, PHI 235, PnI 198, MMI 66, Mtl 81, AbI 204. Relative lengths of antennomeres 1–4 (in % of antennomere 2): 130 100 126 160. Relative lengths of leg segments (in % of metatibia): profemur 56, protibia 60, protarsus 25, mesofemur 66, mesotibia 63, mesotarsus 23, metafemur 83, metatibia 100, metatarsus 29.

Selected measurements of paratypes: BL 2.24 mm (♂), 2.34–2.40 mm (♀♀), HL 0.54 mm (♂), 0.55–0.56 mm (♀♀), HW 0.43 mm (♂), 0.44–0.46 mm (♀♀), A₂L 0.22 mm, 0.21–0.22 mm (♀♀), PW 1.02 mm (♂), 1.04–1.08 mm (♀♀), AW 0.90 mm (♂), 0.92–0.99 mm (♀♀). Indices: PnI 204 (♂), 192–203 mm (♀♀), MMI 64 (♂), 65–67 (♀♀).

Colour (Fig. 3): Black. Buccula pale yellow. Narrow margins of acetabula yellow. Each cell of forewing frosted in proximal part; frosted patches on membrane usually indistinct, if present forming a transverse row of three, plus one patch near apex. Antenna dark brown, first antennomere yellow with infuscated apex. On legs coxae, trochanters, and femora yellow, tibiae and tarsi blackish.

Pilosity: Dorsum of head and thorax, and veins of forewings with golden, subcumbent pilosity (Fig. 3). Venter of body with thin, subcumbent, whitish pilosity.

Structures: Body stout, with short antennae and legs. Head (Fig. 9) short, sides between anterior margin of eyes to small antennal tubercles hardly divergent. Preocular tubercles absent. Anteclypeus strongly compressed, in lateral aspect slightly convex. Buccula (Fig. 10) high, with two ovate, relatively small impressions, posteriorly with one short, angular process. Head side between antennal tubercle and buccula with minute circular impression. Pronotum short and wide, sides with moderately deep emargination; surface, except for anterolateral swellings and humeri, with deep punctures; anteriorly between swellings with three parallel longitudinal impressions. Metanotal elevation (Figs. 11, 12) very short, 1.8 times as wide as long, lateral margins with distinct subapical projections; apex hardly protruded in lateral aspect. Forewing posteriorly reaching apex of abdomen, laterally reaching connexival margins. Legs without modifications. In dorsal aspect, sides of abdomen ovate, apically evenly rounded.

Male: Abdominal sterna 4–6 medially shallowly depressed, but without delimited impression. Sternum 5 medially with dense brush of posteroventrally directed setae (Fig. 14). A few hairs present also on sterna 3 and 4. Genitalia small. Pygophore (Fig. 15) subovate, without modifications. Proctiger (Fig. 16) subrectangular, with left posterior coner slightly produced, with very few setae. Parameres (Fig. 17) small, symmetrical, hook-shaped, apex turned dorsally.

Female: Abdomen without special structures.

Comparative notes: The presence of small transparent cells on its ventral carinae (Fig. 13) distinguishes *T. fenestratus* sp.n. from all other described species of *Timasius*. Another exclusive characteristic is the brush of caudally directed setae on the male's sternum 5 (Fig. 14). The small, stout, short-legged habitus of *T. fenestratus* sp.n. (Fig. 3) resembles species of the *Timasius livens* group, but beside the characters mentioned above, the almost pentagonal shape of the metanotal elevation (Fig. 12) excludes it from that clade. The species cannot be assigned to any of the established species groups.

Discussion on the genus *Neotimasius*

ANDERSEN (1981), in his discussion of *Neotimasius* (p. 405), stated a close relationship with *Timasius* based on six morphological characteristics and separated it from the latter and all other hebrids by “the very prominent, lacelike longitudinal carinae of the thoracic venter and the base of the abdomen” Neither in that study nor in his book “The Semiaquatic Bugs” (ANDERSEN 1982: cladogramme on p. 94), did he present a synapomorphy for the *Timasius* clade.

ZETTEL (2000) was of the opinion that the symmetrical male genitalia of *Neotimasius orientalis* might be a plesiomorphic character compared to asymmetrical male genitalia of *Timasius*. However, a re-examination of *Neotimasius orientalis* revealed a slight asymmetry of its proctiger (on its ventral side), whereas a wide variation from strongly asymmetrical to subsymmetrical genitalia is known in species of *Timasius*. In general, asymmetry is less obvious if the males' genitalia are small, e.g., in *Neotimasius orientalis*, *Timasius jaechi* ZETTEL & CHEN, 2000, and *Timasius fenestratus* sp.n. (Figs. 15–17).

Prior to this study, the high ventral thoracic and abdominal carinae with transparent cells (similar to the impressions on buccula) have been regarded as an exclusive characteristic of *Neotimasius* (ANDERSEN 1981, 1982, ZETTEL 2000). A similar character, although less obvious, is now observed in *Timasius fenestratus* sp.n., thus destroying the proposed exclusiveness.

Several other derived characteristics of *Neotimasius* (as it is presently delimited) are not totally exclusive as well. An extreme spine form of the metanotal apex is also known in *Timasius anderseni* ZETTEL, 2004, which clearly belongs to the monophyletic *Timasius chinai* group (see ZETTEL 2004). *Neotimasius* has also a very characteristically shaped buccula. A strong reduction of the posteroventral tooth of the buccula can be also observed in several *Timasius* species belonging to various species groups. However, such a tooth reduction is usually combined with a reduction of buccula height, except for species of the highly derived *T. distanti* group which is endemic to Taiwan (see MIYAMOTO 1965, ANDERSEN 1981).

A large circular, transparent impression between antennal tubercle and buccula (Figs. 4, 5) is characteristic for the two *Neotimasius* species. Such an impression was not described for *Timasius*, but a minute impression in the same position is present in *Timasius fenestratus* sp.n.

It can be concluded that the two species of *Neotimasius* form a well defined clade of Hebrinae that is based on a good number of extravagant characters. However, there is presently not a single convincing argument that *Neotimasius* is the sister clade of

Timasius, as proposed by ANDERSEN (1981, 1982). It is similarly possible that *Neotimasius* is a highly derived branch in the complex and diverse phylogenetic tree of *Timasius*, which still requires a thorough analysis.

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