# Re-classification of Neodiplogasteridae with notes on the genus *Glauxinema* Allgen, 1947 and description of *G. aquaticum* sp. n. from Vietnam (Nematoda)

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The family Neodiplogasteridae is subdivided into Neodiplogasterinae (= Glauxinematinae) and Mononchoidinae based on the armament of stegostom in the left subventral position. The genera *Glauxinema* Allgen, 1947, *Paraeudiplogaster* Paramonov, 1952, *Diplenteron* Andrőssy, 1964 and *Glauxinemella* Gagarin, 1998 and species *Mononchoides adjunctus* Massey, 1966, *M. andersoni* Ebsary, 1986 and *Glauxinema aphodii* (Bovien, 1937) are restored from synonymy. A key to the genera of Mononchoidinae, emended diagnosis of *Glauxinema*, a list of species of this genus and a key to species are given. *G. aquaticum* sp. n. from the Day River of Vietnam is described and illustrated.

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## Introduction

The last subdivision of Neodiplogasteridae into subfamilies was proposed by Andrőssy (1984). We find this subdivision unsatisfactory and propose here subdivision into two subfamilies based on the armament of stegostom in the left subventral position. The genus *Glauxinema* was erroneously synonymized by Gagarin (1998) with *Mononchoides*, actually these genera belong to different subfamilies. Sudhaus & Fьrst von Lieven (2003) not only accepted this erroneous synonymy, but placed in synonymy further three genera (*Pareudiplogaster*, *Diplenteron* and *Glauxinemella*), which in our opinion are separate taxa. We also restore from synonymy three species names erroneously synonymized by Gagarin (1998). A key to the genera of Mononchoidinae, emended diagnosis of *Glauxinema*, a list of species of this genus and a key to species are given. *G. aquaticum* sp. n. from the Day River of Vietnam is described and illustrated.

## Family **NEODIPLOGASTERIDAE** Paramonov, 1952

*Diagnosis* (from Andrőssy, 1984, emend.). Walls of cheilostom with transverse ribs, separated into 6-12 per- and interradial plates or without ribs, smooth. Cheilostom and gymnostom frequently of equal length. Stegostom long, spacious, or short, in shape of wide ring. Stegostom with dorsal, mobile claw-like tooth and right subventral immovable tooth; in left subventral position with a serrate plate, one or two denticles, or without any armament. Females didelphic, amphidelphic; ovaries antidromous. Bursa in males small, rudimentary. Spicules curved, separate or, very rarely, growing together distally. Tail in both sexes long, with thread-like terminus, or elongate-conoid, with pointed terminus, or conoid, with rounded terminus.

Two subfamilies: Neodiplogasterinae Paramonov, 1952 (= Glauxinematinae Andrőssy, 1984) and Mononchoidinae Andrőssy, 1976.

### Subfamily MONONCHOIDINAE Andrőssy, 1976

*Diagnosis.* Stegostom in left subventral position always with a serrate plate.

Genera included: *Mononchoides* Rahm, 1928; *Fictor* Paramonov, 1952; *Koerneria* Meyl, 1960; *Pristionchus* Kreis, 1932; *Diplenteron* Andrőssy, 1964, **gen. dist.** (not syn. of *Mononchoides*); *Glauxinemella* Gagarin, 1998, **gen. dist.** (not syn. of *Koerneria*).

Subfamily NEODIPLOGASTERINAE Paramonov, 1952

*Diagnosis.* Stegostom in left subventral position with one or two denticles, or without any armament.

Genera included: *Neodiplogaster* Cobb, 1924; *Oigolaimella* Paramonov, 1952; *Micoletzkya* Weingдrtner, 1955; *Pareudiplogaster* Paramonov, 1952, **gen. dist.** (not syn. of *Mononchoides*); *Glauxinema* Allgen, 1947, **gen. dist.** (not syn. of *Mononchoides*).

**Key to the genera of Neodiplogasterinae**

1(2). Walls of cheilostom without ribs, smooth; spicules growing together distally . . . . . **Pareudiplogaster** Paramonov, 1952
2(1). Walls of cheilostom with ribs, transversely striated; spicules separate.
3(4). Stegostom short, in shape of wide ring; labial sensillae long, bristle-shaped . . . . . **Oigolaimella** Paramonov, 1952
4(3). Stegostom long, spacious; labial sensillae short, in shape of elongate papillae.
5(6). Stegostom in shape of long and thin cylinder, 6-10 times as long as wide, with wing-like apodemes at posterior end . . . . . **Neodiplogaster** Cobb, 1924
6(5). Stegostom in shape of shorter cylinder, not more than 3 times as long as wide, without apodemes at posterior end.
7(8). Stegostom in left subventral position with two denticles; tail, as a rule, elongate-conoid . . . . . **Micoletzkya** Weingдrtner, 1955
8(7). Stegostom in left subventral position without denticles; tail, as a rule, long, with thread-like terminus . . . . . **Glauxinema** Allgen, 1947

Genus **Glauxinema** Allgen, 1947

Syn.: *Prosodontus* Paramonov & Sobolev in Skrjabin et al., 1954 (part).

Type species: *Glauxinema filicaudatum* Allgen, 1947.

*Diagnosis* (from Andrбssy, 1984, emend.). Body length 0.7-1.5 mm. Males smaller and slenderer than females. Cuticle thin, with fine transverse striae and 20-40 longitudinal ridges from head to tail base. Head continuous with body. Front edge of head flattened. Labiotuberculus armed with six setiform labial papillae surrounding oral opening. Males, in addition, have four setiform papillae situated behind the former ones. Amphid opening slit-lake, at level of metastomal tooth. Buccal cavity (stoma) divided into two parts: broader anterior part, consisting of cheilo- and gymnostom, and narrowed and longer posterior part, consisting of stegostom only. Cheilostom spaceous, barrel-shaped; its walls with twelve strongly cuticularized, curved ribs. In anterior part of stegostom, a large, claw-like, mobile, strongly cuticularized dorsal tooth bifurcated at apex. In right subventral position, a small, stick-like, immovable denticle, which may be absent in some species. In left subventral position teeth and denticles absent. Total length of stoma equal to or greater than head width. Pharynx slender, sharply divided into two sections: anterior muscular section and posterior glandular section. Anterior section of pharynx as long as or longer than its posterior section. Females didelphic, amphidelphic, with antidromous ovaries. Vulva in most species anterior to mid-body. Testis simple, bent. Spicules separate, slender, slightly curved, with handle-like capituli. Gubernaculum curved, thin; its proximal end claw-like, often with dent; apical end often with "muff", which comprises ends of spicules. Bursa small, rudimentary. In males, nine to ten sexual setiform papillae: three pairs precloacal and six to seven pairs postcloacal (caudal). Tail long, with filiform terminus in both sexes. Female tail usually longer than distance between vulva and anus. Tail usually shorter in male than in female.

## List of species

**G. americanum** (Steiner, 1930) Chitwood & Chitwood, 1937. Syn.: *Diplogaster americana* Steiner, 1930; *Mononchoides americanus* (Steiner, 1930) Chitwood & Chitwood, 1937; *Diplogaster* (*Eudiplogaster*) *americana* (Steiner, 1930) Weingдrtner, 1955; *Eudiplogaster americana* (Steiner, 1930) Paramonov, 1952.

**G. andrassyi** (Timm, 1961) Andrбssy, 1984. Syn.: *Diplogaster* (*Eudiplogaster*) *andrassyi* Timm, 1961; *Eudiplogaster andrassyi* (Timm, 1961) Timm, 1961; *Mononchoides andrassyi* (Timm, 1961) Gagarin, 1998.

**G. aphodii** (Bovien, 1937) Andrбssy, 1984. Syn.: *Diplogaster aphodii* Bovien, 1937; *Prosodontus aphodii* (Bovien, 1937) Paramonov & Sobolev, 1954 in Skrjabin et al., 1954; *Diplogaster* (*Eudiplogaster*) *aphodii* (Bovien, 1937) Meyl, 1961.

**G. aquaticum** sp. n.

**G. filicaudatum** Allgen, 1947. Syn.: *Mononchoides filicaudatus* (Allgen, 1947) Gagarin, 1998.

**G. flagellicaudatum** (Andrбssy, 1962) Andrбssy, 1984. Syn.: *Eudiplogaster flagellicaudata* Andrбssy, 1962; *Mononchoides flagellicaudatus* (Andrбssy, 1962) Gagarin, 1998.

**G. schwemmlei** (Sachs, 1950) Andrбssy, 1984. Syn.: *Diplogaster schwemmlei* Sachs, 1950; *Diplogaster* (*Eudiplogaster*) *schwemmlei* (Sachs, 1950) Weingдrtner, 1955; *Eudiplogaster schwemmlei* (Sachs, 1950) Paramonov, 1952; *Prosodontus schwemmlei* (Sachs, 1950) J.B. Goodey in T. Goodey, 1963; *Mononchoides schwemmlei (*Sachs, 1950) Gagarin, 1998.

**G. splendidum** (Kцrner, 1954) Andrбssy, 1984. Syn.: *Diplogaster* (*Eudiplogaster*) *splendida* Kцrner, 1954; *Eudiplogaster splendida* (Kцrner, 1954) Andrбssy, 1958; *Mononchoides splendidus (*Kцrner, 1954) Goodey, 1963.

**G. trichuris** (Cobb, 1893) Andrбssy, 1984. Syn.: *Diplogaster trichuris* Cobb, 1893; *Mononchoides trichuris* (Cobb, 1893) Goodey, 1963.

Morphometric characters of these species are given in Table 1.

*Taxonomic notes.* Andrбssy (1984) included nine species in the genus *Glauxinema*: all the listed above (except the new one) plus *G. armatum* (Hofmaenner, 1913).

**Table 1.** Measurements of species of the genus *Glauxinema* (all characters for females, except length of spicules).

| Characters | *americanum* | *andrassyi* | *aphodii* | *filicaudatum* | *flagellicaudatum* | *schwemmlei* | *splendidum* | *trichuris* | *aquaticum* |
|---|---|---|---|---|---|---|---|---|---|
| *L*, mm | 0.85 | 1.08-1.42 | 0.9-1.2 | 1.0 | 0.85 | 0.73-0.98 | 1.14-1.30 | 1.5 | 1.0-1.1 |
| *A* | 18 | 25-36 | 15-17 | 30 | 34 | 13-16 | 27-36 | 3.2 | 30-37 |
| *B* | 5.9 | 6.8-7.9 | 5.3-6.0 | 6.8 | 7.2 | 5.1-6.8 | 6.3-6.7 | 8.3 | 6.0-6.5 |
| *C* | 4 | 2.4-3.0 | 5.5-6.6 | 2.9 | 2.7 | 8.4-9.8 | 3.1-3.4 | 1.85 | 3.5-3.7 |
| *C'* | 10 | 18-28 | 6 | 15 | 20 | 4-6 | 20 | >30 | 16.3-18.6 |
| *V*, % | 46 | 35-42 | 53 | 40 | 38 | 55-57 | 41-42 | 28 | 37-42 |
| Ratio: stoma length/ head width | 1.0 | 1.4 | >1 | 1 | >1 | 1 | 1 | >1 | 2.1-2.2 |
| Ratio: stoma posterior part/stoma anterior part | >1 | 1.0 | >1 | >1 | >1 | >1 | >1 | 2.0 | 1.3-1.5 |
| Ratio: pharynx anterior section/ pharynx posterior section | 2.0 | 1.5 | 1.5 | 1.0 | 2.0 | 1.0 | 1.0 | 1.5 | 1.4-1.6 |
| Ratio: tail/ vulva-anus | 0.7 | 1.5 | 0.5 | 1.5 | 1.5 | 0.3 | 1.1-1.3 | 3.0 | 0.9-1.1 |
| Length of spicules (along arch), μm | 45 | 36-42 | 37-39 | – | 32-35 | 28-36 | 37-43 | 44 | 31-34 |

**Table 2.** Measurements of *Glauxinema aquaticum* sp. n.

| Characters | Males | | | Females | |
|---|---|---|---|---|---|
| | Holotype | 4 paratypes | | 4 paratypes | |
| | | range | mean | range | mean |
| *L*, μm | 859 | 833-885 | 854 | 1001-1089 | 1044 |
| *A* | 39 | 38-40 | 39 | 30-37 | 34 |
| *B* | 5.5 | 5.2-5.6 | 5.4 | 6.0-6.5 | 6.3 |
| *C* | 3.8 | 3.6-4.0 | 3.8 | 3.5-3.7 | 3.6 |
| *C'* | 10.9 | 10.7-12.3 | 11.3 | 16.3-18.6 | 17.5 |
| *V*, % | – | – | – | 36.7-42.4 | 40.6 |
| Head width, μm | 8.5 | 8.5-9.0 | 8.5 | 8.5-9.5 | 9.0 |
| Stoma length, μm | 21 | 20-21 | 21 | 18-21 | 20 |
| Ratio: posterior part of stoma/anterior part of stoma | 1.3 | 1.3-1.5 | 1.4 | 1.4-1.5 | 1.4 |
| Ratio: anterior section of pharynx/ posterior section of pharynx | 1.4 | 1.4-1.5 | 1.4 | 1.4-1.6 | 1.5 |
| Pharynx length, μm | 155 | 153-161 | 157 | 160-169 | 165 |
| Posterior end of pharynx-vulva, μm | – | – | – | 245-323 | 285 |
| Posterior end of pharynx-cloaca, μm | 476 | 452-501 | 470 | – | – |
| Vulva-anus, μm | – | – | – | 266-333 | 301 |
| Tail length, μm | 228 | 217-241 | 227 | 287-297 | 294 |
| Spicules length (along arch), μm | 31 | 31-34 | 33 | – | – |
| Gubernaculum length, μm | 15 | 14-15 | 14 | – | – |

The latter, according to the original description and illustration (Hofmaenner, 1913), has in stegostom a serrate plate in left subventral position and should be placed in *Mononchoides*. Gagarin (1998) erroneously placed in synonymy 3 species, which are even not congeneric and should be restored: *Glauxinema aphodii* (Bovien, 1937), **sp. dist.** [not syn. of *Mononchoides armatus* (Hofmaenner, 1913)], *Mononchoides adjunctus* Massey, 1966, **sp. dist.** [not syn. of *Glauxinema americanum* (Steiner, 1930)] and *Mononchoides andersoni* Ebsary, 1986 [not syn. of *Glauxinema andrassyi* (Timm, 1961)].

**Key to species of *Glauxinema***

1(6). Subventral denticle in stoma absent.
2(3). $V$ = 41-42%, $c$ = 3.1-3.4, $c'$ = 20 . . . **G. splendidum**
3(2). $V$ = 53% or more; $c$ = 5.5 or more; $c'$ = 6 or less.
4(5). Anterior section of pharynx as long as its posterior section; $c$ = 8.4-9.8 . . . . . **G. schwemmlei**
5(4). Anterior section of pharynx 1.5 times as long as its posterior section; $c$ = 5.5-6.6 . . . . . **G. aphodii**
6(1). Subventral denticle in stoma present.
7(8). $V$ = 28%, $c$ = 1.85, $c'$ = 30 or more . . . **G. trichuris**
8(7). $V$ = 35% or more, $c$ = 2.4 or more, $c'$ = 28 or less.
9(10). Anterior section of pharynx as long as its posterior section . . . . . **G. filicaudatum**
10(9). Anterior section of pharynx 1.3-2.0 times as long as its posterior section.
11(12). Length of stoma equal to head width; spicules 45 μm long . . . . . **G. americanum**
12(11). Length of stoma more than one head width; length of spicules 42 μm or less.
13(14). Body 0.85 mm long . . . . . **G. flagellicaudatum**
14(13). Body 1.0 mm long or more.
15(16). Tail 1.5 times as long as distance between vulva and anus, $c$ = 2.4-3.0, $c'$ = 18-28 . . . . . **G. andrassyi**
16(15). Tail 0.9-1.1 times as long as distance between vulva and anus; $c$ = 3.5-3.7, $c'$ = 16.3-18.6 . . . . . **G. aquaticum** sp. n.

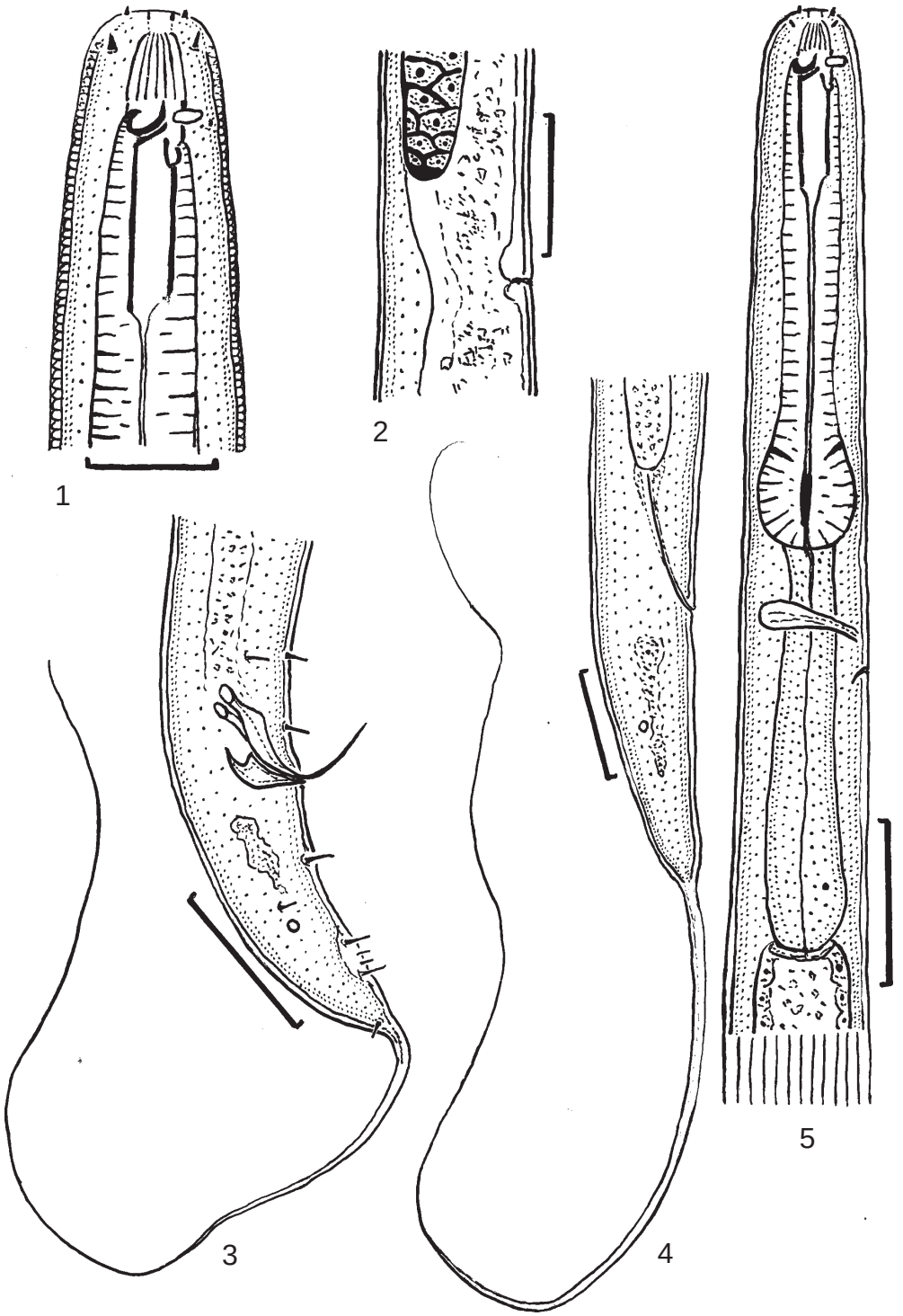
## **Glauxinema aquaticum** sp. n.
(Figs 1-5)

*Holotype.* ♂, **Vietnam,** *Hoa Binh Prov.*, Day River, depth 1 m, silt, 10.VIII.2003, slide no. 71/ II, deposited at the Institute of Inland Waters Biology, Borok, Yaroslavl Prov.

*Paratypes.* 4 ♂, 4 ♀, collected with holotype, deposited at the Institute of Ecology and Biological Resources, Hanoi, Vietnam.

*Measurements.* See Table 2.

*Description. Female.* Small, slender nematodes. Cuticle thin, with fine transverse striation and 24-26 longitudinal ridges. Anterior end of body tapering. Head flattened anteriorly. Lips absent. Six short setiform papillae surround oral opening. Stoma narrow, 2.1-2.2 times as long as head width. Cheilostom with 12 strongly cuticu-




**Figs 1-5**. *Glauxinema aquaticum* sp. n. **1**, head of male; **2**, vulva region; **3**, tail of male; **4**, tail of female; **5**, anterior end of body. Scale bar: 10 µm (*1*); 30 µm (*2-5*).

larized curved ribs. Gymnostom in shape of wide ring. Stegostom with large, mobile, claw-like dorsal tooth, its apical end bifurcated. Right subventral denticle small, thin. In left subventral position teeth and denticles absent. Stegostom in shape of long cylinder, 1.3-1.5 times as long as its anterior part. Amphid openings small, ellipsoidal, situated at the level of dorsal tooth. Pharynx slender, sharply divided into two sections: anterior muscular section and posterior glandular section. Anterior part of pharynx 1.4-1.6 times as long as its posterior section. Excretory pore situated posterior to nerve ring. Cardia narrow, muscular. Rectum 1.3-1.7 times as long as anal body diameter. Gonads didelphic, amphidelphic; ovaries antidromous. Ovarial bend long, almost reaching vulva. Vulva preequatorial, in the shape of ellipsoidal slit. Vulval lips not cuticularized, not protruded. Vagina short. Uterus containing one or two eggs, measuring 45-53 Ч 20-23 μm. Tail long, strongly tapering at base, thereupon thin and filiform.

*Male.* General appearance similar to that of female, size smaller. Cuticle thin, with fine transverse striation and 24-26 longitudinal ridges. Head with four supplementary setae about 1.0-1.2 μm long situated posterior to six labial setiform papillae. Structure of stoma and pharynx similar to those of female. Amphid openings in the shape of small transverse ellipse situated at the level of dorsal tooth. Testis simple. Spicules slender, ventrally curved, with rounded capituli; their apices pointed. Spicules 1.5 times as long as cloacal body diameter. Gubernaculum 2.3-2.5 times shorter than spicules. Tail long, strongly tapering at its base, thereupon thin and filiform. Ten pairs of sexual setiform papillae: 3 pairs precloacal and 7 pairs postcloacal (caudal). Bursa strongly rudimentary.

*Comparison.* The new species is similar in size to *G. andrassyi* (Timm, 1961), but has a shorter tail (females $c$ = 3.5-3.7, $c'$ = 16.3-18.6, males $c$ = 3.6-4.0, $c'$ = 10.7-12.3 *vs.* females $c$ = 2.4-3.0, $c'$ = 18-28, males $c$ = 2.17-3.2, $c'$ = 12-16 in *G. andrassyi*), shorter spicules and gubernaculum (which are 31-34 μm and 14-15 μm long, respectively, in the new species *vs.* 36-42 μm and 17-19 μm in *G. andrassyi*), another ratio of anterior and posterior parts of stoma (in the new species, posterior part of stoma 1.3-1.5 times as long as its anterior part, but in *G. andrassyi* length of anterior part of stoma is equal to the length of its posterior part), another ratio of tail/vulva-anus distance (in the new species, tail 0.9-1.1 times as long as distance from vulva to anus, *vs.* in *G. andrassyi* tail 0.5 times as long as distance from vulva to anus) and another structure of dorsal claw-like tooth (apex of this tooth not bifurcate in *G. andrassyi*) (Timm, 1961; Table 1 in present article).

*Etymology.* The species name means “from water”.

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