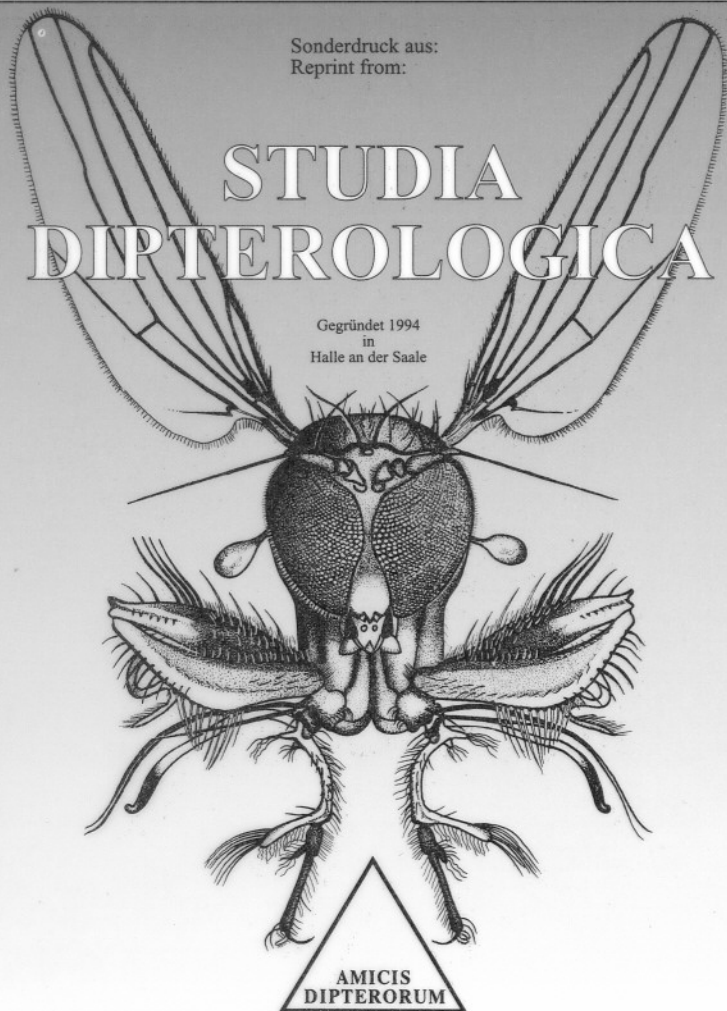


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Genus *Culicoides* (Diptera, Ceratopogonidae) collected by non-light traps in South Moravia

[Aufsammlungen von Arten der Gattung *Culicoides* (Diptera, Ceratopogonidae) in Südmähren mittels Fallen, die nicht auf der Lockwirkung von Licht basieren]

by

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Abstract Biting midges of the genus *Culicoides* are usually collected using special kinds of light traps. This haematophagous genus is of considerable medical and veterinary importance, and finding new ways of capturing them is important for improving knowledge of their bionomy and for more efficient control. The material examined here was collected using non-light traps: Malaise, emergence, pan traps and car net. 17 species of the genus *Culicoides* are now known from South Moravia, and two of them – *Culicoides (Oecacta) furcillatus* CALLOT, KREMER & PARADIS, 1962 and *C. (O.) pseudoheliophilus* CALLOT & KREMER, 1961 – are recorded from the Czech Republic for the first time.

Key words *Culicoides*, Ceratopogonidae, 'non-light' traps, Moravia, Czech Republic

Zusammenfassung Gnitzen der Gattung *Culicoides* werden gewöhnlich mit Hilfe spezieller Lichtfallen gefangen. Diese blutsaugende Gattung ist von human- und veterinärmedizinischer Bedeutung und die Entwicklung neuer Fangmethoden ist wichtig, um bessere Kenntnis von ihrer Bionomie zu erhalten und um eine effizientere Bekämpfung zu ermöglichen. Das gesamte untersuchte Material wurde mit Fallen gesammelt, die nicht auf der Lockwirkung von Licht basieren: Malaise-Fallen, Emergenzfallen, Farbschalen und Autokäscher. Aus Südmähren sind nun 17 Arten der Gattung *Culicoides* bekannt. Hiervon wurden zwei, d. h. *Culicoides (Oecacta) furcillatus* CALLOT, KREMER & PARADIS, 1962 und *C. (O.) pseudoheliophilus* CALLOT & KREMER, 1961, zum ersten Mal in der Tschechischen Republik gefunden.

Stichwörter *Culicoides*, Malaise-Fallen, Farbschalen, Autokäscher, Mähren, Tschechische Republik

Introduction

About 230 species of the genus *Culicoides* are reported from the Palearctic region (ARNAUD & WIRTH 1964), 63 species of which have been reported from former Czechoslovakia (ORSZÁGH 1980). From the Czech Republic, 47 species of *Culicoides* were reported (ORSZÁGH et al. 1997). In this study, 15 species (32 % of the Czech fauna of the genus *Culicoides*) have been recorded and 2 species from South Moravia on the territory of the Czech Republic for the first time. This genus is well known as biting pests and for its role in the transmission of a variety of pathogens of man and animals with two peaks of his daily and annual activity (KREMER 1965). Haematophagous *Culicoides* species are generally trapped by different kinds of light traps, traps using CO₂ or nulliparous females (ANDERSON & LINHARES 1989, GERRY & MULLENS 1998, MRÁZ & ORSZÁGH 1998, MULLENS & GERRY 1998). Collecting haematophagous *Culicoides* by Malaise, emergence, pan traps and car net with almost the same success is probably a new way in obtaining specimens of this genus.

Material and methods

Biting midges were found on 11 localities in NP Podyji: Havraníky (1), Hnanice (2), Horní Břečkov (3), Čížovský rybník (4), Liščí skála (5), Braitava (6), Fládnická chata (7), Pod Šóbesem (8), Zadní Hamry (9), Ledové sluje (10)

and Braitava – Letohrádek (11). Species of the genus *Culicoides* have been found on 7 of them: Loc. 1, 2, 3, 5, 6, 10, and 11. The material was collected during 2001–2002 as follows:

1. During year 2001:

A) MT, Yellow and White Pan Traps throughout a year

Havraníky (1) - steppe-heathland - 1.5 km SW of Havraníky, 48.48.29 N, 15.59.31 E, 340 m.

Hnanice (2) - deciduous wood (edge of damp deciduous wood, including ecoton and residual Phragmitetum, 1.5 km NW of Hnanice, 48.48.12 N, 15.58.22 E, 300 m.

Horní Břečkov (3) – near pond, wetland often flooded, 1.5 km W of H. Břečkov, 48.53.28 N, 15.52.32 E, 400 m.

Liščí skála (5) – forest - steppe (Quercetum, 2.5 kmS of Podmolí, 48.49.48 N, 15.56.28 E, 420 m.

B) irregularly sampled localities (car net, ET, SW)

Braitava (6) – deciduous wood, 1.5 km SE of Vranov n./Dyji, 48.53.23 N, 15.49.42 E, 440 m.

Havraníky (1) - steppe, 0.5 km NW of Havraníky, sweeping, 48.48.53 N, 15.59.58 E, 350 m.

2. During year 2002:

A) MT, ET, throughout a year

Ledové sluje (10) – Pod Ledovými slujemi – lowland wood, 48.53.09 N, 15.50.29 E, 290 m.

Braitava - Letohrádek (11) – mixed forest, 48.52.35 N, 15.50.03 E, 520 m.

B) only MT, throughout a year

Havraníky (1) – steppe-heathland, sparse growth of *Pinus nigra*, 48.48.52 N, 15.59.48 E, 330 m.

Malaise traps: A special type of trap of own construction was used. The central wall was formed by a triangle made of soft PES material (WILAS). The front wall was 90 cm broad and the collecting head, filled with 70 % ethylalcohol, was held by a wooden pole. The collecting head (PE bottle, 1 litre volume) was changed each every 3–5 weeks and collected material was placed in a freezer.

Emergence traps: Triangle-shaped traps (construction very similar to the roof of Malaise trap) were filled usually with a heap of decaying wood, fungi, mosses, sieved leaf litter, etc. The collecting head, similar to that of the Malaise trap, was filled with 70 % ethylalcohol and treated as described above.

Yellow and White Pan Water Traps: In each studied locality, 20–30 traps were used. These were made of plastic pans for ice-cream cakes (diameter 13 cm, depth 3 cm, producer Technoplast Chropyně), with the inner face painted with Industrol 6200 (bright sunflower yellow, white). These pans were distributed in all microhabitats of the locality usually along the transect, separated 3–5 m apart. YPWT were filled with water and detergent (e. g. JAR without additional colours and perfumes) at a rate of 5 ml for every 10 litres of water. After 3 days of trap exposition, the collected material was washed in a fine sieve under lukewarm running water at least one minute and then immersed in absolute (96 %) ethylalcohol in such way that the alcohol did not increase the volume of the sample. After 24 hours, the alcohol was changed for a 70 % solution, and then the samples were stored in a freezer.

Car net: Two car nets 41 × 58 cm were mounted on the roof of a car. The nets were made of monofil[®] attached to metal frame. A small dose of a “knock-down” pyrethroid insecticide was applied to the tip of each net before each sampling round to prevent escapes of flies. The car was driven about 40 km/h fast on a circuit of 100 km (2 days – 2 samples – 2 circuits). After each round nets were emptied into entomological net and material was immediately stored in 70 % ethylalcohol. Material was sorted in the laboratory using dissecting microscope with 20× and selected specimens were identified. Only about 1/4 of the total sample was selected in the case of common morphospecies and progressively more in the case of rare morphospecies (TÓTHOVÁ et al. 2004).

Results

About 300 specimens of the genus *Culicoides* from the collected material have been examined and 17 species identified. Two species are first recorded on the territory of the Czech Republic: *Culicoides (Oeacta) furcillatus* CALLOT, KREMER & PARADIS, 1962 and *C. (O.) pseudoheliophilus* CALLOT & KREMER, 1961. The identified species are listed below.

Explanations: L – number of locality, SO – seasonal occurrence, T – used trap (MT - Malaise trap, ET – emergence trap, PT – pan trap, CN – car net), NS – number of collected specimens, CZ – Czech Republic.

Culicoides (Avaritia) obsoletus (MEIGEN, 1818) – L: 1, 3, 4, 5, 6. SO: iv.–x. T: CN, MT, PT. NS: 7♂♂, 61♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.

C. (A.) scoticus DOWNES & KETTLE, 1952 – L: 5. SO: viii.–xi. T: MT. NS: 2♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.

C. (Culicoides) pulicaris (LINNAEUS, 1758) – L: 3, 5. SO: v.–xi. T: MT. NS: 2♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.

C. (C.) punctatus (MEIGEN, 1804) – L: 3, 5, 6. SO: iv.–viii. T: CN, MT. NS: 1♂, 49♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.

- C. (Oecacta) achrayi* KETTLE & LAWSON, 1955 – L: 2. SO: vi.–vii. T: MT. NS: 1 ♀, leg. BARTÁK, det. ORSZÁGH.
- C. (O.) fascipennis* (STAEGER, 1839) – L: 6. SO: v.–vi. T: CN. NS: 3 ♂♂, 47 ♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.
- C. (O.) festivipennis* KIEFFER, 1914 – L: 1, 5, 6. SO: v.–viii. T: CN, MT. NS: 51 ♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.
- C. (O.) furcillatus* CALLOT, KREMER & PARADIS, 1962 – L: 3. SO: v.–vi. T: MT. NS: 1 ♂, leg. BARTÁK, det. ORSZÁGH. First record for CZ.
- C. (O.) jurensis* CALLOT, KREMER & DEDUIT 1962 – L: 2. SO: vi.–vii. T: MT. NS: 1 ♀, leg. BARTÁK, det. ORSZÁGH.
- C. (O.) kibunensis* TOKUNAGA, 1937 – L: 3, 6. SO: v.–vii. T: CN, MT, PT. NS: 3 ♂♂, 32 ♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.
- C. (O.) minutissimus* (ZETTERSTEDT, 1855) – L: 3. SO: vi.–vii. T: MT. NS: 1 ♂, leg. BARTÁK, det. ORSZÁGH.
- C. (O.) pallidicornis* KIEFFER, 1919 – L: 3, 6. SO: v.–vi. T: CN, MT. NS: 2 ♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.
- C. (O.) pictipennis* (STAEGER, 1939) – L: 2, 3, 6, 10, 11. SO: iv.–vi. T: CN, MT, PT, ET. NS: 2 ♂♂, 16 ♀♀, leg. BARTÁK, det. KNOZ & TÓTHOVÁ.
- C. (O.) pseudoheliophilus* CALLOT & KREMER, 1961 – L: 10. SO: v.–vi. T: MT, ET. NS: 4 ♂♂, 1 ♀♀, leg. BARTÁK, det. ORSZÁGH. First record for CZ.
- C. (O.) subfascipennis* KIEFFER, 1919 – L: 2, 3. SO: vi.–vii. T: MT. NS: 4 ♀♀, leg. BARTÁK, det. KNOZ & ORSZÁGH.
- C. (O.) reconditus* CAMPBELL & PELHAM–CLINTON, 1960 – L: 6. SO: v.–vi. T: CN. NS: 1 ♀, leg. BARTÁK, det. ORSZÁGH.
- C. (O.) truncorum* EDWARDS, 1939 – L: 10. SO: v.–vi. T: MT. NS: 1 ♀, leg. BARTÁK, det. ORSZÁGH.

Discussion

In South Moravia, 15 previously reported species of the genus *Culicoides* (32 % of the total Czech fauna) and 2 *Culicoides* species recorded in the Czech Republic for the first time have been captured using non-light traps.

This haematophagous genus has been a frequent object of research in respect to its importance in human and veterinary medicine. The reason is that this genus includes potential vectors of many virus diseases (e. g. bluetongue, AHS). In most of the studies on this genus, specimens have been collected by means of different types of light traps, traps with CO₂ or nulliparous females. This study is the first report about capturing haematophagous biting midges by non traditional types of traps. Most efficient in this case was collecting by car net and Malaise traps. These types of traps may be highly efficient for quick monitoring of the populations, determination of daily flight activity and swarming places. More than 82 % of identified species have been collected with car net on a single study locality. Therefore, an ecological evaluation would not reflect the real conditions within the whole study area. Thus, this collecting method seems to be a good way to learn about the spectrum of species of any dipteran family on a given study locality.

The genus *Culicoides* was generally studied by GUTSEVICH (1973), who reported 113 species from the USSR and also described their bionomy. A British study on *Culicoides* (BOORMAN 1986) reports on 48 species. Except of *C. truncorum*, *C. impunctatus* and *C. heliophilus* that were attracted to CO₂-baited traps all the others were captured by light traps. The genus *Culicoides* is well studied for its medical and veterinary importance and there are many papers presenting their local faunistics on the territory of former Czechoslovakia (ORSZÁGH 1969b, 1971, 1974, ORSZÁGH & MINÁŘ 1986, MRÁZ & ORSZÁGH 1998). There were recorded 19 species of the genus *Culicoides* collected on duck and calves farms by means of light traps (ORSZÁGH & SELNEKOVIČOVÁ – HUČKOVÁ 1986), 25 species from East Slovakia collected by light traps (TRPIŠ & ORSZÁGH 1971), 16 species collected by means of UV light and sweeping (ORSZÁGH 1969a), 11 species collected by UV light in the area of the Biological Station of the Faculty of Science, Comenius University “Jurský Šúr” near Bratislava (ORSZÁGH 1968). From Bohemia and Moravia, KNOZ (1978) has reported 31 species of the genus *Culicoides*. During 1976–1979, KNOZ & VAŇHARA (1982) reported 18 species of the genus *Culicoides* captured by light traps in South Moravia. In the same territory, 27 species have been reported during 1980–

1983 (KNOZ & MICHÁLEK 1987). KNOZ & VAŇHARA (1991) found 34 species of this haematophagous genus in the area's floodplain forests. In one of the latest studies, KNOZ (1997) has reported 5 species of the genus *Culicoides* for the first time for former Czechoslovakia. From the Pálava Biosphere Reserve, 34 species of *Culicoides* have been reported (KNOZ 1998). The material in all the above-mentioned studies has been captured by light traps, sporadically also with sweeping net and CO₂-baited traps.

The research in the Pálava Biosphere Reserve (KNOZ 1998) is one of the latest complex studies bringing notes about this haematophagous genus. The 34 species reported from this area cover also species found in the Podyjí National Park, but here 4 additional species have been captured by means of non-light traps (MT, ET), i. e. *C. furcillatus*, *C. jurensis*, *C. pseudohelophilus*, and *C. truncorum*.

The present study reports a number of species recorded by means of untraditional collection methods comparable to numbers obtained by the commonly used methods. This is true not only for the genus *Culicoides* but also for the entire family Ceratopogonidae. Besides the mentioned first records attention should be also paid to the record of *C. minutissimus*. This is an extremely rare species, especially its males being hardly ever found using traditional methods of collecting. Identified species presented in this study are compared with species identified on the territory of Czech and Slovak Republics in selected studies, which represent some of the earliest and latest works on this genus (Table 1).

Tab. 1: Comparison of the reported species in selected studies on the territory of former Tchechoslovakia.

Reference	ORSZÁGH 1968	KNOZ 1978	MRÁZ & ORSZÁGH 1998	KNOZ 1998	TÓTHOVÁ et al. 2004
<i>Culicoides</i> LATREILLE, 1809					
sg. <i>Avaritia</i> FOX, 1955					
<i>abchazicus</i> DZHAFAROV, 1964	-	-	-	-	-
<i>chiopterus</i> (MEIGEN, 1830)	-	+	+	-	-
<i>dewulfi</i> GOETGHEBUER, 1936	-	+	-	+	-
<i>obsoletus</i> (MEIGEN, 1818)	+	+	+	+	+
<i>scoticus</i> DOWNES & KETTLE, 1952	-	+	+	+	+
sg. <i>Beltranmyia</i> VARGAS, 1953					
<i>circumscriptus</i> KIEFFER, 1918	+	-	+	+	-
<i>manchuriensis</i> TOKUNAGA, 1941	-	-	-	-	-
<i>salinarius</i> KIEFFER, 1914	+	-	+	+	-
<i>sphagnumensis</i> WILLIAMS, 1955	-	-	-	-	-
sg. <i>Culicoides</i> s. str.					
<i>delta</i> EDWARDS, 1939	-	+	+	-	-
<i>fagineus</i> EDWARDS, 1939	-	+	-	+	-
<i>grisescens</i> EDWARDS, 1939	-	+	-	-	-
<i>impunctatus</i> GOETGHEBUER, 1920	-	+	-	+	-
<i>newsteadi</i> AUSTEN, 1921	-	-	+	-	-
= <i>halophilus</i> KIEFFER, 1924					
<i>pulicaris</i> (LINNAEUS, 1758)	+	+	+	+	+
<i>punctatus</i> (MEIGEN, 1804)	-	+	+	+	+
sg. <i>Monoculicoides</i> KHALAF, 1954					
<i>longicollis</i> GLUKHOVA, 1971	-	-	-	-	-
<i>nubeculosus</i> (MEIGEN, 1830)	+	-	-	+	-
<i>parroti</i> KIEFFER, 1922	-	-	-	-	-
<i>puncticollis</i> (BECKER, 1903)	-	-	-	-	-
<i>riethi</i> KIEFFER, 1914	+	-	+	+	-
<i>stigma</i> (MEIGEN, 1818)	-	-	-	+	-

Reference	ORSZÁGH	KNOZ	MRÁZ &	KNOZ	TÓTHOVÁ
	1968	1978	ORSZÁGH 1998	1998	et al. 2004
sg. <i>Oecacta</i> POEY, 1851					
<i>achrayi</i> KETTLE & LAWSON, 1955	-	+	+	+	+
<i>albicans</i> (WINNERTZ, 1852)	-	-	-	+	-
<i>alazanicus</i> DZHAFAROV, 1961	-	-	+	+	-
= <i>musilator</i> KREMER & CALLOT, 1961					
<i>brunnicans</i> EDWARDS, 1939	-	-	-	-	-
<i>cameroni</i> CAMPBELL & PELHAM-CLINTON, 1960	-	-	-	-	-
<i>comosioculatus</i> TOKUNAGA, 1956	-	+	-	-	-
<i>duddingstoni</i> KETTLE & LAWSON, 1955	-	-	+	+	-
<i>dispersus</i> GUTSEVICH & SMATOV, 1966	-	-	-	-	-
<i>dzhafarovi</i> , REMM, 1967	-	-	-	+	-
<i>fascipennis</i> (STAEGER, 1839)	+	+	+	+	+
<i>festivipennis</i> KIEFFER, 1914	+	+	+	+	+
= <i>odibilis</i> AUSTEN, 1921					
<i>furcillatus</i> CALLOT, KREMER & PARADIS, 1962	-	-	-	-	+
<i>haranti</i> RIOUX, DESCOUS & PECH, 1959	-	-	-	+	-
<i>heliophilus</i> EDWARDS, 1921	-	+	-	+	-
<i>jurensis</i> CALLOT, KREMER & DEDUIT, 1962	-	-	-	-	+
<i>kibunensis</i> TOKUNAGA, 1937	-	+	+	+	+
= <i>cubitalis</i> EDWARDS, 1939					
<i>maritimus</i> KIEFFER, 1924	-	+	+	+	-
<i>minutissimus</i> (ZETTERSTEDT, 1855)	-	-	-	+	+
<i>pallidicornis</i> KIEFFER, 1919	+	+	+	+	+
<i>pictipennis</i> (STAEGER, 1939)	+	+	+	+	+
<i>pseudoheliophilus</i> CALLOT & KREMER, 1961	-	-	-	-	+
<i>reconditus</i> CAMPBELL & PELHAM-CLINTON, 1960	-	+	-	+	+
<i>segnis</i> CAMPBELL & PELHAM-CLINTON, 1960	-	+	-	+	-
<i>semimaculatus</i> CLASTRIER, 1958	-	-	-	+	-
<i>shaklawensis</i> KHALAF, 1957	-	-	-	+	-
<i>simulator</i> EDWARDS, 1939	+	+	+	+	-
<i>subfasciipennis</i> KIEFFER, 1919	-	+	+	+	+
<i>truncorum</i> EDWARDS, 1939	-	-	+	-	+
= <i>sylvarum</i> CALLOT & KREMER, 1961					
<i>ustinovi</i> SCHEVCHENKO, 1962	-	-	-	+	-
<i>vexans</i> (STAEGER, 1839)	-	-	+	+	-
<i>vidourensensis</i> KREMER, MOLET & BACH, 1968	-	-	-	-	-
<i>zhogolevi</i> REMM, 1968	-	-	-	-	-
sg. <i>Pontoculicoides</i> REMM, 1968					
<i>saevus</i> KIEFFER, 1922	-	-	-	-	-
<i>slovacus</i> ORSZÁGH, 1969	-	-	-	-	-
<i>tauricus</i> GUTSEVICH, 1959	-	-	-	-	-

The area reaching from South Moravia to South Slovakia is an imaginary border of the expansion of southern thermophilous species. From here such species might penetrate further north, thus extend their range (e. g. species of related family Culicidae - *Aedes albopictus* (SKUSE, 1895) - vector of Dengue virus) and transmit diseases hitherto not occurring in this area. For that reason, it is very important to control the populations of haematophagous insects in South Moravia, biting midges included. For example, the blue tongue virus (BTV) transmitted by *Culicoides*, was not a serious problem in Europe, except for sporadic outbreaks in Spain and Portugal (thought to be caused by infected insects being carried by the wind from North Africa). However, since 1998 BTV has been moving further north into Europe. In the last five years

outbreaks have been reported from Bulgaria, Serbia, Kosovo, Croatia, Montenegro, northern Greece and Bosnia Herzegovina, Corsica, Sardinia, Menorca, Sicily and mainland Italy.

The use of non-light traps may be highly efficient in monitoring local populations of haematophagous biting midges. In combination with light traps, the whole spectrum of the studied group can be captured. These methods may be a useful complement of traditional collecting methods for other haematophagous dipterans as well.

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