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Homoeothrix fusca i jej formy w Wielkim Stawie
w Dolinie 5 Stawów Polskich w Tatrach

Homoeothrix fusca and its forms in the Lake Wielki Staw
in the Valley of the Five Polish Lakes (High Tatra Mts)

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Abstract — The diagnosis of the blue-green alga *Homoeothrix fusca* Starm., first described from the Tatra Mts in 1934, has now been changed and completed. In the species four forms are distinguished: *H. fusca* f. *fusca*, *H. fusca* f. *minor*, *H. fusca* f. *elongata*, and *H. fusca* f. *longissima*. These were determined on the basis of material collected in September 1963 from the lake Wielki Staw in the High Tatra Mts. The samples were taken from the edge of the lake in the undulation zone as well as from the depths of 0.5 and 5 m.

The species *Homoeothrix fusca* was described for the first time from material collected in several oligotrophic Tatra lakes and their effluents (Starmach 1934). In the years 1928—1933 it was found in the lake Czarny Staw Gąsienicowy and its effluent, in the lake Zmarzły Staw near the road to the Zawrat Pass, and in the lakes Przedni Staw and Wielki Staw in the Valley of the Five Polish Lakes. Filaments not exceeding 100 μ in length, occurring in small clusters in the inshore zone of the lake at a depth of 10—30 cm. were regarded as the typical form. Apart from these, longer filaments, up to 160 μ , were regularly encountered in deeper water. The form with longer filaments was called f. *elongata*. Godward (1937) described from the lake Windermere in North England a still longer form, reaching 250 μ in length, and named it f. *britannica*. Moreover, a form of *H. fusca* was found among thalli of *Pleurocapsa* in a rock crack, along which water trickled from the wall of the Mt. Wielka Świstówka in the West Tatra. It formed small clusters composed of filaments not exceeding 40 μ in length. This form was called f. *minor* (Starmach 1934).

The above-mentioned forms differ very little with regard to the breadth of trichomes measured at the base of filaments. On the other hand, the length of the filaments measured from the base to the apex of the hair is different. Worthy of note is the shape of the sheaths. The typical form, as well as *f. minor*, have the broadest and layered sheaths, which are sometimes frayed on the surface. In the form *britannica* and *elongata* the sheaths adhere, they are narrow, not frayed at the apices, their stratification is for the most part invisible.

Table I. Dimensions of trichomes in the forms of *Homoeothrix fusca* according to data reported by Starmach (1934) and Godward (1937)

Form	Breadth of trichomes at the base of filaments	Length of trichomes together with hair
<i>H. fusca</i> f. <i>fusca</i>	2,0-3,5 μ	48-85 μ
<i>H. fusca</i> f. <i>minor</i> Starmach	1,2-2,5 μ	25-40 μ
<i>H. fusca</i> f. <i>elongata</i> Starmach	2,0-3,0 μ	75-160 μ
<i>H. fusca</i> f. <i>britannica</i> Godward	1,5-2,0 μ	50-250 μ

The division of the species into forms is to some extent conventional. It is based on the dimensions of the length and breadth, and possibly on the shape of the sheaths. Among the forms described so far there exists a vast scale of variation. The breadth of trichomes at the base lies within the range 1.2—3.5 μ , their length, together with the hair, amounting to 25—250 μ . The sheaths are fairly thick and layered or else they are smooth with indistinct stratification. The common feature of these forms is the shape of trichomes and the violet-black colour of the sheaths. The latter feature, however, is not stable, since sometimes, although seldom, there also occur sheaths that are weakly coloured or even almost colourless. The features of forms known so far are listed in Table 1.

In September 1963 stones overgrown with algae were collected in the lake Wielki Staw in the Valley of the Five Polish Lakes from a depth of 0—0.2, 0.2—0.5 m. and 5, 10, 10, 30 and 40 m. In this material *H. fusca* occurred in the inshore zone at a depth of 0—5 m. Moreover, all the forms reported above were also found, as well as specimens of much greater length than those hitherto described. The development and length of filaments were distinctly related to the depth and undulation of the water.

At the shore, in the zone of undulation and splashing of water, among crustlike blue-green algae *Pleurocapsa polonica* and *Chamaesiphon polonicus*, there occurs exclusively the form *minor* with short filaments and trichomes up to 2.5 μ thick at the base. On stones regularly covered by undulating water the typical form (*H. fusca* f. *fusca*) with trichomes up to 3.5 μ thick and up to 100 μ long is definitively the dominant form. It prevails to a depth of 0.5 m., although on the lateral side of the stones, thus, as if „in the shadow” of undulation, much longer filaments are encountered, belonging already to *f. elongata* or *f. britannica*. Below, up to

5 m., there occur almost exclusively long and narrow filaments whose length reaches up to 456 μ . They grow in loose clusters among other algae covering stones in this zone.

Thus, in the inshore zone of the Wielki Staw one could readily observe the occurrence of all the hitherto described forms, as well as of other, still longer ones. The particular forms are evidently related to the depth and undulation of the water. In extreme habitats, only temporarily wetted by the water, there occur small, at it were, dwarf clusters of *H. fusca* f. *minor*. On stones regularly covered by undulating water the form *fusca* develops, recognized in 1934 by the author as typical. In places screened from undulation and at greater depths a form with long filaments prevails, determined at one time as form *elongata* and f. *britannica*. In deeper water very long filaments are encountered almost exclusively.

In the Wielki Staw the typical form is the one most strongly developed. Its filaments are up to 150 μ long, the trichomes at the base being up to 3.6 μ broad. All forms, however, are distinctly related with each other by transitions of continuous character and represent typical local forms, depending on the conditions of the habitat. For this reason, the discrimination of taxonomic units lower than the species can only be conventional in this case. The most practical would be a division into: short forms, 20—50 μ in length, medium (or typical) forms, 50—150 μ in length, long forms, up to 250 μ , and very long forms, being in the given material up to 456 μ in length. The breadth of trichomes is less characteristic. In the same clusters trichomes of varying breadth are encountered, this being related to age but also to the density of the arrangement of the filaments in the cluster, when growing closely trichomes press against each other.

Hence, the author offers for consideration a complement to the diagnosis of the species described in 1934, suggesting its division into 4 forms: f. *minor*, f. *fusca*, f. *elongata*, and f. *longissima*. As compared with the former diagnosis, the filaments of f. *minor* remain within the range 25—50 μ and are characteristic of the zone of water splash. The filaments of the typical form (f. *fusca*) lie within wider limits: formerly 46—85 μ , at present 50—150 μ . They are the most characteristic of the conditions prevailing in the Wielki Staw and are related to the zone of inshore undulation in a layer of water of 10—50 cm. F. *elongata* with filaments 150—250 μ long is characteristic of quiet places in inshore water. F. *longissima* occurs in deeper water though at a depth of 5 m. it is found only very rarely.

Corrected diagnosis

Homoeothrix fusca, Starmach 1934, occurs in the form of erect separate clusters of filaments violet-black in colour. The single filaments

are variously bent, usually curved as the base, lying, then rising, not branched, often matted together. The sheaths in the basal parts of the filaments are fairly thick, layered, uneven on the outside, sometimes frayed, further up smooth, adhering to the trichomes, even at the apex or bevelled, shorter than the trichomes. In elongated forms the whole sheath is narrow and smooth, unstratified or of indistinct stratification visible only in the basal parts of the filament. The colour of the sheaths is violet-black, very characteristic as compared with other blue-green algae.

The trichomes are broadened from below but not bulbous, further up gradually becoming narrower, passing into a colourless hair of varying length. The incisions at cross-walls are invisible or hardly distinguishable in the basal parts of the trichomes. The cells are greyish-blue-green with a fine-grained content. Their length varies: in the basal parts of trichomes they are shorter than they are broad, further up they are square, while in the hairs they are always longer than they are broad.

The trichomes are of various dimensions. In the basal parts, always the broadest, they are 2.5—3.6 μ thick and in the central parts 1.5—3.0 μ thick. Their length ranges from 25 to 456 μ (this referring to the specimens investigated in the Wielki Staw). As compared with the dimensions of trichomes, the breadth of filaments amounts to 3.5—4 μ and in the central parts to 2.5—3.2 μ .

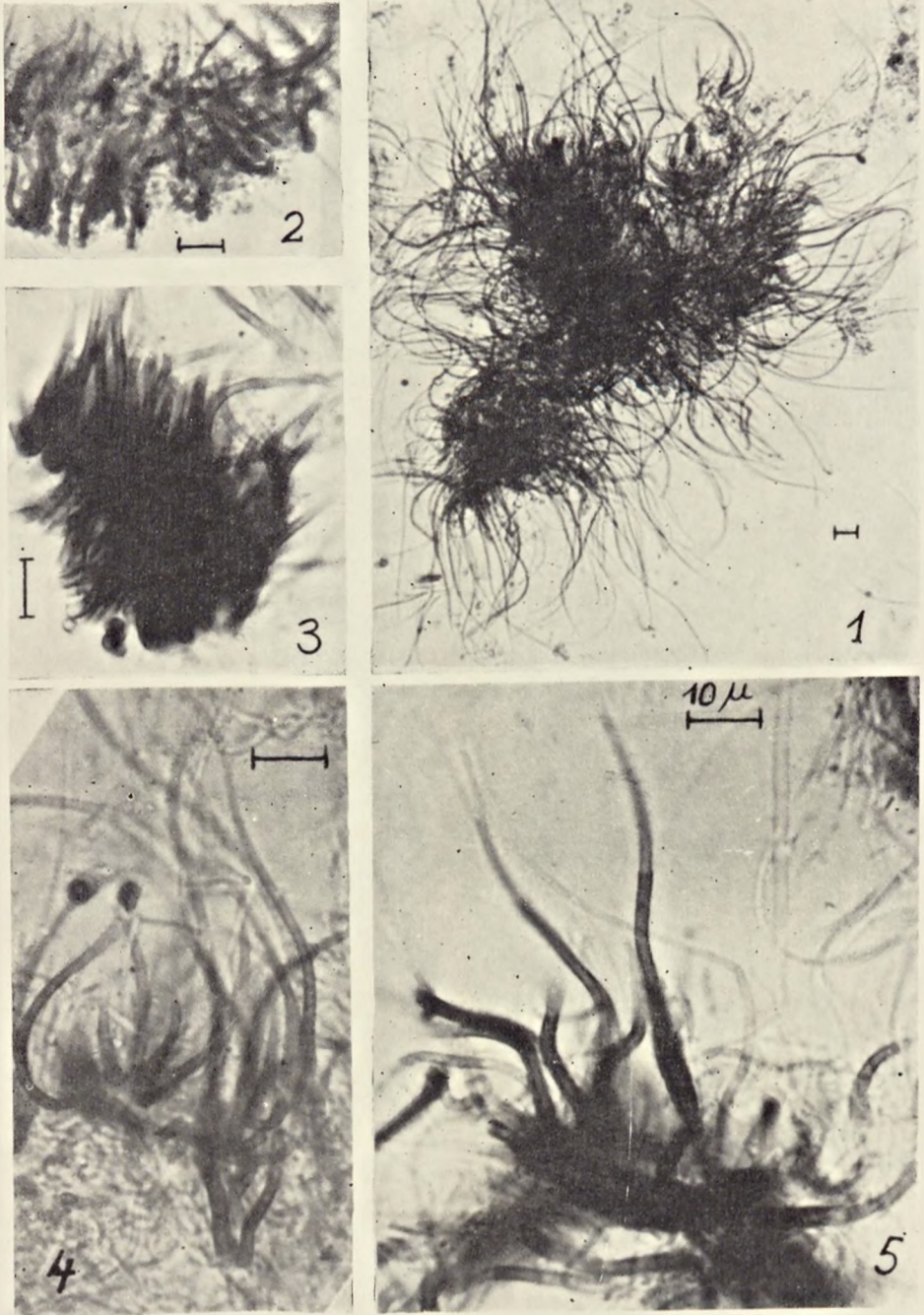
Considerable differences are observed in the length of trichomes and development of sheaths according to the habitat and especially to the movement of the water (Figs. 1—7). These differences justify the division of the species into forms which, although related with each other by transitions, are distinctly different in the determined habitats (Table II).

H. fusca f. *fusca* (Starmach 1934, 1966), as a typical form, occurs in shallow water in the zone of inshore undulation, as well as in the effluent of the lake among crust-like algae (chiefly *Chamaesiphon polonicus*) overgrowing stones. The breadth of trichomes for this form is 2.0—3.5 μ and the length 50—150 μ .

H. fusca f. *minor*, Starmach 1934 occurs at the shore of the lake on stones not permanently immersed in water but only intermittently washed over. The filaments are very small, the trichomes being 1.2—3.0 μ broad and 25—50 μ long and the sheaths usually thick.

H. fusca f. *elongata* Starmach 1966. (*H. fusca* f. *elongata* Starmach 1934, f. *britannica* Godward 1937). This form occurs in calm water to depth of ± 1 m. The filaments in the lower part are bent in the shape of a hook while further up they are curved. The sheaths are smooth and narrow, sometimes being thickened at the base. The trichomes are 2—3 μ broad.

H. fusca f. *longissima* Starmach 1966. The filaments are 250—456 μ long and 2.0—3.0 μ broad, strongly bent and often matted together.



Figs. 1—5. *Homocothrix fusca*: 1 — *f. longissima*, a group of filaments pressed under the preparation cover glass; 2, 3 — *f. fusca*, typical aggregates of filaments; 4, 5 — *f. elongata*, typically shaped groups of filaments

They occur as a rule in deeper water, up to a depth of 5 m. The sheaths are smooth, adhering to the trichomes.

The above diagnosis, as compared with the previous one from the year 1934 and with the description of the material from Lake Windermere

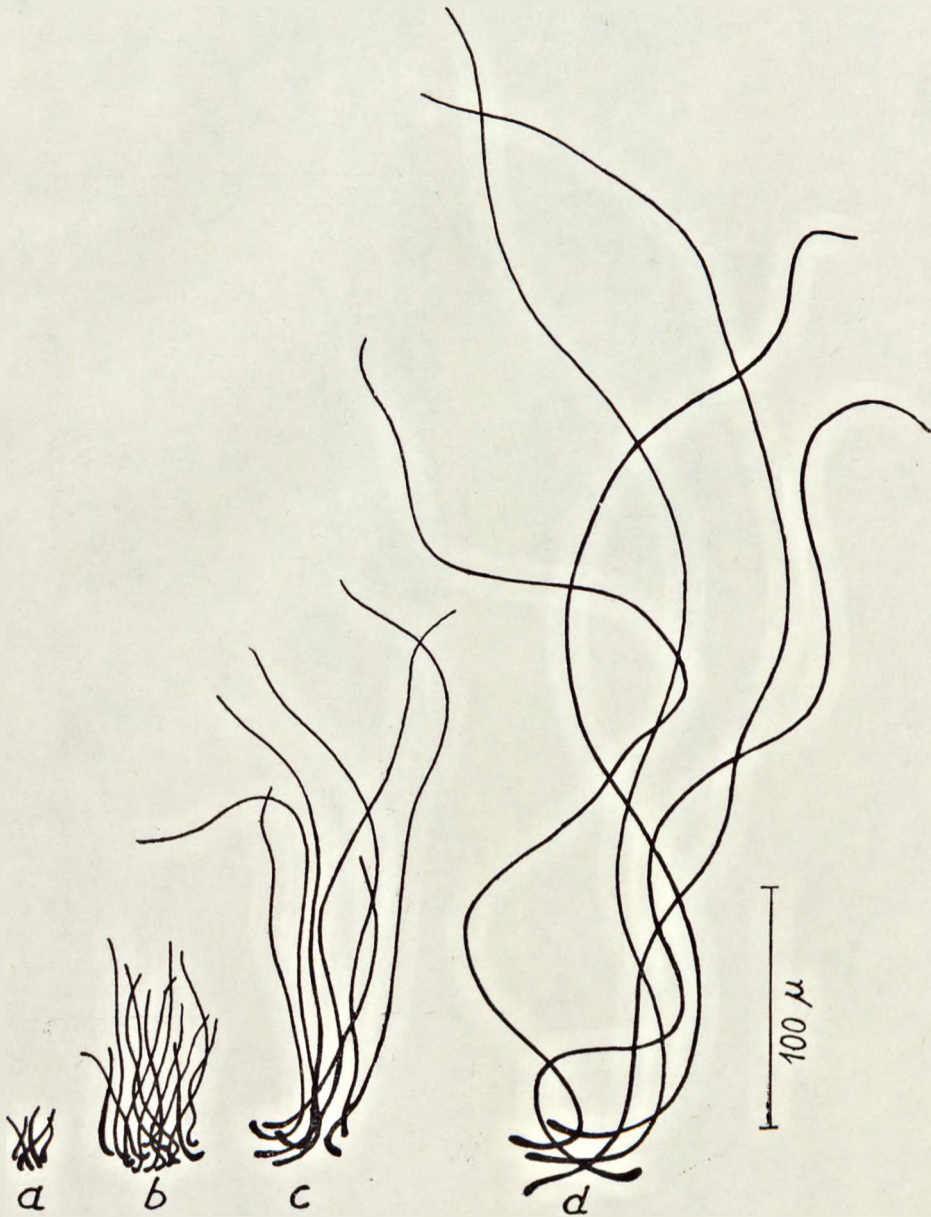


Fig. 6. Habit of filament: a — *Homoeothrix fusca* f. *minor*, b — *H. fusca* f. *fusca*, c — *H. fusca* f. *elongata*, d — *H. fusca* f. *longissima*

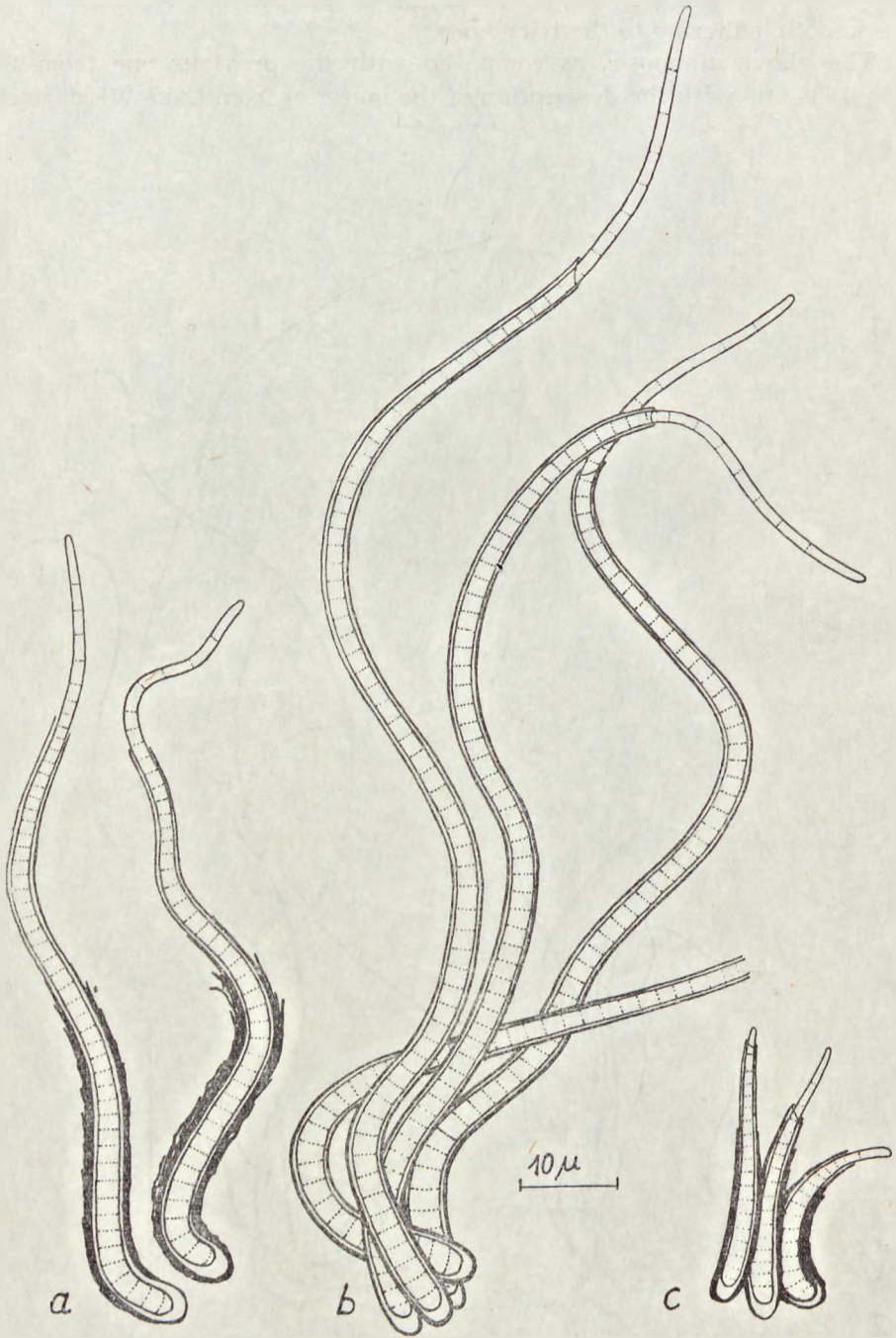


Fig. 7. *Homoeothrix fusca* f. *fusca*, variously shaped sheath of filaments; c — *H. fusca* f. *minor*

Table II. Dimensions of trichomes in forms *Homoeothrix fusca* according to the new division

Form	Breadth of trichomes at the base of filaments	Length of trichomes together with hair
<i>H. fusca</i> f. <i>fusca</i>	2.0–3.5 μ	50–150 μ
<i>H. fusca</i> f. <i>minor</i> Starmach 1934	1.2–3.0 μ	25–50 μ
<i>H. fusca</i> f. <i>elongata</i> Starmach 1966	2.0–3.0 μ	150–250 μ
<i>H. fusca</i> f. <i>longissima</i> Starmach 1966	2.0–3.0 μ	250–456 μ

(Godward 1937), was completed and corrected on the basis of material collected in September 1963 in the lake Wielki Staw in the Valley of the Five Polish Lakes in the Tatra Mountains.

Iconotype: Figs. 6 and 7, and photographs (figs. 1–5).

STRESZCZENIE

Na podstawie materiału zebranego w Wielkim Stawie w Dolinie 5 Stawów Polskich na brzegu w strefie falowania wody oraz na głębokości 0,5, 1 i 5 m poprawiono i uzupełniono diagnozę gatunku *Homoeothrix fusca*. Gatunek ten opisany był po raz pierwszy przez Starmacha (1934). W obrębie gatunku wyróżniono 4 formy. Są one wprawdzie powiązane ze sobą przejściami, jednak w określonych siedliskach wyraźnie od siebie różne.

1. *Homoeothrix fusca* f. *fusca* Starmach 1934, 1967, jako forma typowa występuje w wodzie płytkiej przy brzegu stawu, a także w odpływie stawu wśród glonów skorupiastych, głównie *Chamaesiphon polonicus*, porastających kamienie. Szerokość trychomów wynosi 2,0–3,5 μ , długość 50–150 μ .

2. *H. fusca* f. *minor* Starmach 1934, 1967, występuje na obrzeżach stawu na kamieniach okresowo tylko zwilżanych wodą. Trychomy są u nasady 1,2–3,0 μ szerokie, 25–50 μ długie.

3. *H. fusca* f. *elongata* Starmach 1934, 1967, Godward 1937 jako f. *britannica*. Występuje w wodzie spokojnej zwykle do głębokości 1 m. Nici są szczególnie w dolnej części silnie powyginane, pochwy gładkie. Szerokość trychomów wynosi 2–3 μ , długość 150–250 μ .

4. *H. fusca* f. *longissima* Starmach 1967, spotykana jest z reguły w wodzie głębszej aż do głębokości 5 m. Nici są zawsze dłuższe niż 250 μ , 2–3 μ szerokie, silnie powyginane.

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