

# Microbial carotenoid biosynthesis potential of uncommon marine protists

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## Biosynthesis potential

Carotenoids are a valuable class of compounds whose applications can be significantly expanded through improved and cheaper availability [1]. Preliminary results from the cultivation of a large and as yet unstudied collection of thraustochytrids show that these unusual marine protists are a potential source of biotechnologically derived carotenoids. Moreover, their production can be influenced by varying the culture medium. In this way, the production of different types of carotenoids can also be stimulated. The aim of the project is to investigate the collection to find promising strains for the production of various carotenoids.

## Carotenoids

Carotenoids are a group of pigments and derivatives of tetraterpenes. Their antioxidative properties led to the application in pharmacology, as nutritional supplements and in cosmetics. Biotechnological production processes of carotenoids often suffer from small yields, mainly due to low densities of the production organisms accompanied. Different optimization approaches are necessary to improve the efficiency in carotenoid production. The selection of an optimal production organism is one of them.

## Marine protists

Thraustochytrids are a relatively unexplored group of protists and ubiquitous in marine ecosystems. They play an important role in nutrient recycling [2,3]. Some strains are successfully used for the production of  $\omega$ -3-fatty acids [4]. Moreover, they are known for the synthesis of carotenoids [5-7] (fig.1).

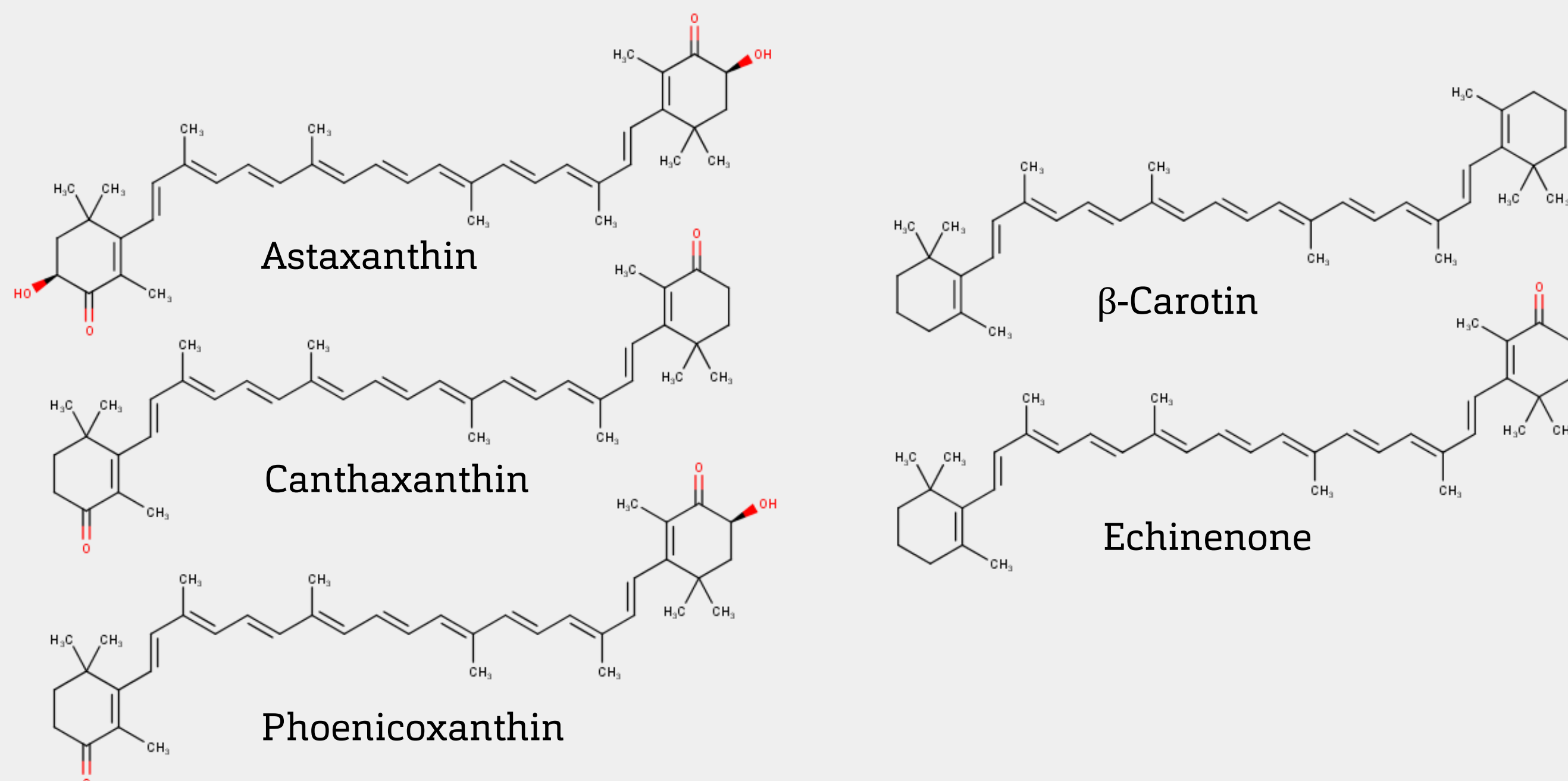


Figure 1: Some carotinoids, that are synthesized by thraustochytrids [5-7].

Thraustochytrids have the potential to reach higher cell densities in production than the commonly used microorganisms. Therefore, it is likely to reach higher yields [8]. A collection of over 200 uncharacterized thraustochytrids originating from the North and Baltic Sea are characterized based on morphology and 18S rRNA gene comparison. A screening for the carotenoid biosynthesis is performed. A media variation as well as the induction of external parameters shall further improve the yield with regard to up-scaling.

## Collection and analysis

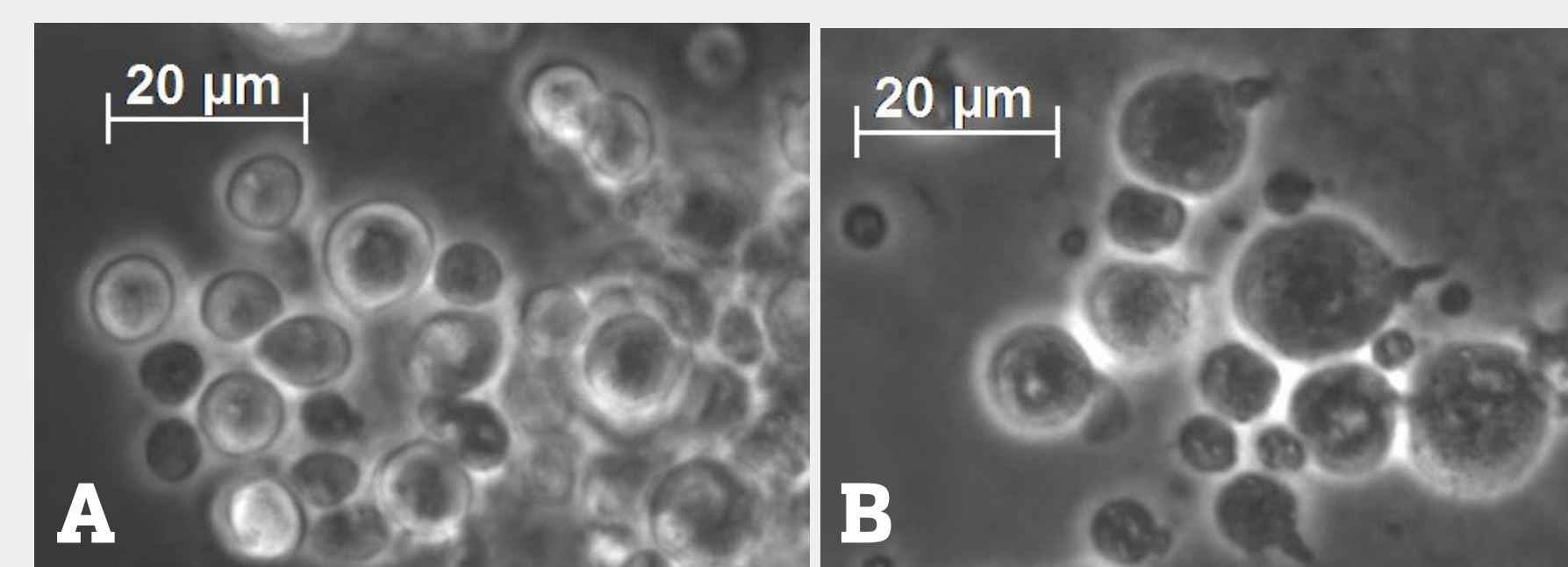


Figure 2: Coccal, unicellular thraustochytrids (10 to 50  $\mu$ m). Many of them build ectoplasmic nets. A: basic structure of strain 1450d, B: strain 1473e with extracellular compartments.

Strains of the culture collection were compared by morphology (fig. 2) and identified by 18S rRNA gene comparison. They were assigned to *Thraustochytrium* and *Ulkenia*, two families of Thraustochytriaceae (fig. 3). The strains clustering in 18S rRNA gene comparison showed similarity in their morphology, growth behaviour, media requirements and pigment patterns as well.

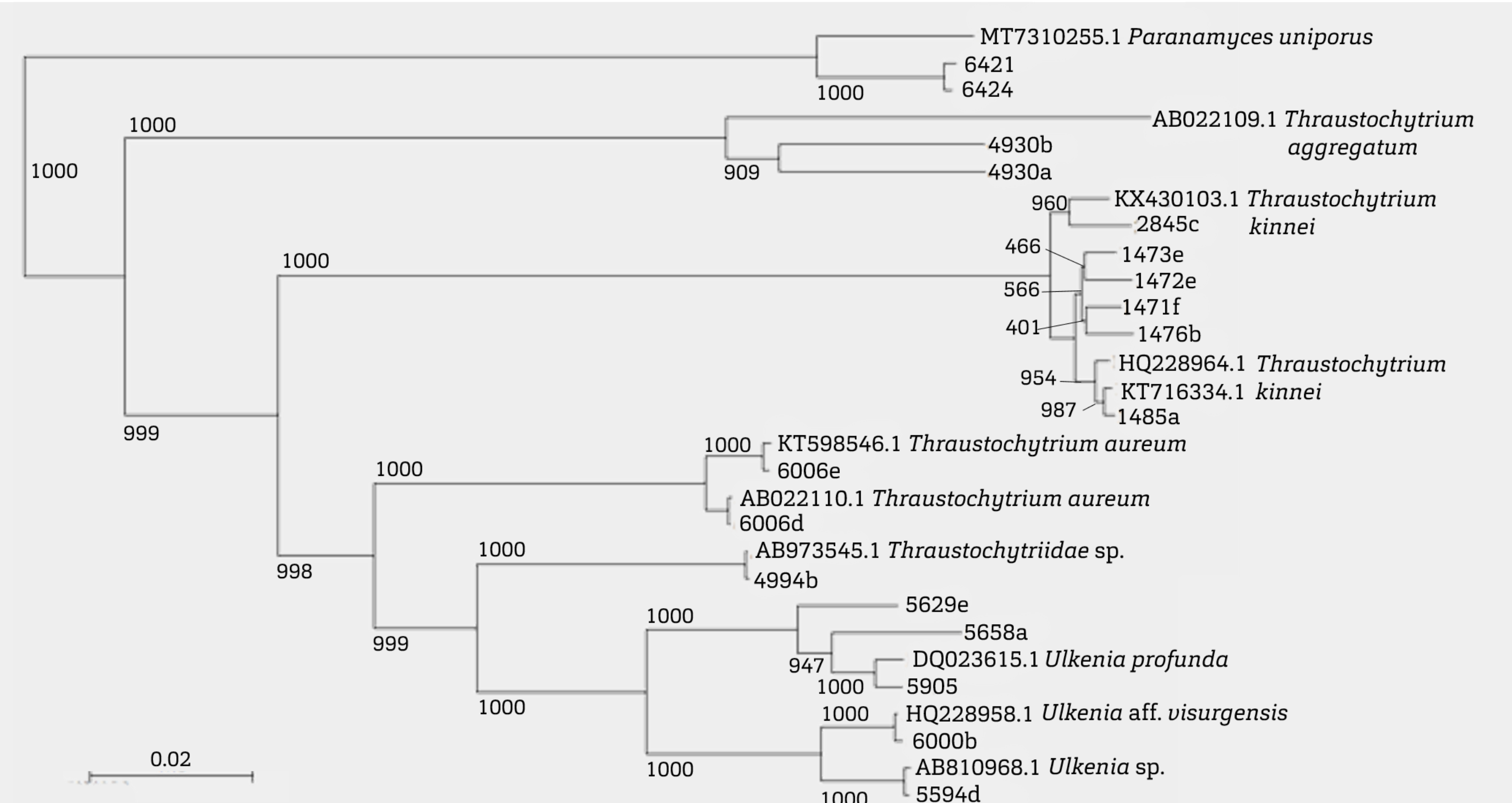


Figure 3: Phylogenetic tree of 18 isolates based on their 18S rRNA genes and neighbour-joining algorithm. Fungal sequences of *Paranamyces uniporus* were used as outgroup. The numbers at the branches show the bootstraps values calculated for 1000 replicates. Sequences from [9] and GenBank were used for comparison.

The synthesis of pigments is influenced by variation of the composition of the culture media (fig. 4). These experiments will be repeated for qualification and quantification to characterize the carotenoid spectra in detail.

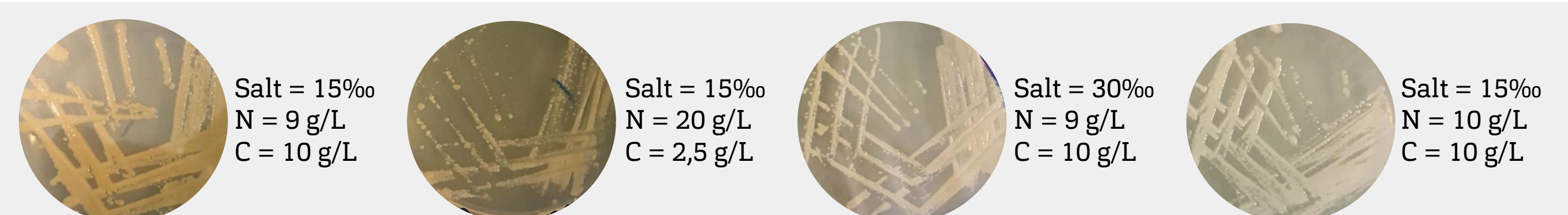


Figure 4: Strain 6006d on a selection of various culture media. The same strain showed a changed color spectrum induced by the media composition.

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