

## **Supplementary Discussion: Extended Taxonomic Summary**

ZooBank registration of the work: urn:lsid:zoobank.org:pub:F6FDDC88-E27E-4C40-A75B-3D0627D86ABB.

### **Supergroup *Disparia* Valt & Čepička, new supergroup**

Clade-based definition: Eukaryotes more closely related to Hemimastigophora, Provora, and Caelestes phyl. nov. than to Metamonada, Discoba, Sar, Telonemia, Haptista, Pancryptista, Archaeplastida, Amoebozoa, Obazoa, CRuMs, Ancyromonadida, or Malawimonadida.

Included phyla: *Disparia* phyl. nov.; Hemimastigophora Foissner, Blattner & Foissner, 1988; Provora Tikhonenkov et al., 2022.

Etymology: A noun derived from the Latin adjective *dispār*, dissimilar, disparate.

### **Clade *Membrifera* Valt & Čepička, nom. nov.**

Clade-based definition: Eukaryotes more closely related to Hemimastigophora and Caelestes phyl. nov. than to Provora.

Included phyla: *Disparia* phyl. nov.; Hemimastigophora Foissner, Blattner & Foissner, 1988.

Etymology: From a Latin adjective *membrifera*, here considered a noun. Derived from *membrum*, a limb, + the suffix *-fera*, nom. pl. of *-fer*, bearing. Refers to the arms of *Meteora*, the tail of spironemids and *Solarion*, and the extrosome-bearing stalks of *Solarion*, which remind us of legs.

### **Phylum *Caelestes* Valt & Čepička, phyl. nov.**

Diagnosis: Eukaryotes with bundles of microtubules arising from MTOC and forming support for arms or stalks that protrude from the cell and bear celestiosomes.

Included taxa: *Meteora* Hausmann, Weitere, Wolf & Arndt, 2002; *Solarionidae* fam. nov.

Etymology: From the Latin noun *caelestis*, an entity of the heavens. Refers to the similarity of names of the included genera, *Meteora* and *Solarion*, with celestial bodies (a meteor and the Sun, respectively).

### **Family *Solarionidae* Valt & Čepička, fam. nov.**

Zoobank registration: urn:lsid:zoobank.org:act:48610B0A-E62B-48A5-9172-9B8F9D24F610.

Diagnosis: As for the genus *Solarion*.

Type and only included genus: *Solarion* gen. nov.

## Genus *Solarion* Valt & Čepicka, gen. nov.

Zoobank registration: urn:lsid:zoobank.org:act:52DABEFE-57FE-498E-BA63-D5BA4895FFCF.

Diagnosis: Unicellular eukaryotes with two cell types: rounded sun-like cell with multiple stalks, each bearing a terminal extrusome, and elongated flagellate with a single flagellum and a prominent posterior tail.

Type and only included species: *Solarion arienae* sp. nov.

Etymology: from the Latin adjective *solaris*, “of the sun” + the noun-forming suffix *-ion*. Refers to sun-like cells. Male gender.

### *Solarion arienae* Valt & Čepička, sp. nov.

Zoobank registration: urn:lsid:zoobank.org:act:8C0C1FF3-C34B-4A43-8E8A-51819DC37330.

Description: Sun-like cells are rounded,  $4.2 \pm 0.45$  (3.3 - 5.2)  $\mu\text{m}$  in diameter (N=51), and can produce numerous stalked extrusomes  $1.9 \pm 0.85$  (0.3 - 5.4)  $\mu\text{m}$  (N=369) in length. A protargol-stained sun-like cell shows argyrophilic tips of extrusomes inside and outside of the cell, surrounding glycocalyx and an eccentrically-positioned nucleus (Fig. 1f). The flagellates are  $5.4 \pm 1.38$  (2.9 - 8.8)  $\mu\text{m}$  (N=42) long and  $3.3 \pm 0.46$  (2.3 - 4.2)  $\mu\text{m}$  (N=42) wide. A single, apically inserting, posterolaterally directed flagellum is  $10.4 \pm 1.66$  (3.1 - 11.8)  $\mu\text{m}$  (N=42) long, and the cell bears a thicker, immotile posterior tail that is  $6.6 \pm 1.99$  (6.7 - 15.2)  $\mu\text{m}$  (N=42) long. The flagellum beats posteriorly, planarly, in a symmetrically sinusoidal wave pattern, while the posterior tail remains mostly rigid, only pursuing the movements.

Type locality: Marine sediment isolated from 30 m deep sea in Sumartin, Croatia,  $43^\circ 17' \text{N}$   $16^\circ 52' \text{E}$ .

Habitat: Marine shallow hypoxic sediments.

Holotype: Protargol-stained cell of the strain SUM-K depicted in Fig. 1f, deposited in the collection of the National Museum in Prague, Czechia, inventory number P6E 5580.

Etymology: Named after Arien, a fictional female character who carried the vessel of the Sun in The Silmarillion written by J. R. R. Tolkien.

Gene sequence: An 18S rRNA gene sequence (strain SUM-K) is available in GenBank (accession number: PQ368572).