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Digital formula for the identification of Meliolaceae

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This paper deals with a digital formula applicable to meliolaceous fungi. It consists of three groups of digits. The first group of four digits uses eleven characters to distinguish the genera. The second group of five digits uses nineteen characters to denote arrangement of appressoria and morphology of head cells of appressoria, location of the phialides in the colony, morphology of the mycelial setae and septation in ascospores. The third group of five digits uses twenty three characters distinguishing the measurements of individual parts.

Keywords: Digital formula, Meliolaceae, Black mildews, Ascomycetes.

Beeli (1920) proposed a numerical code to categorize members of the Meliolaceae. Stevens (1927, 1928) modified and extensively used this code in his work. Hosagoudar (1996), Hosagoudar & al. (1997), Hu & al. (1996, 1999) and Mibey & Hawksworth (1997) have followed Hansford (1961) in using this code as key character and also supplemented the code with other characters to distinguish the individual taxa. The Beeli's code or formula, however, has some limitations, such as:

1. the code does not distinguish all the genera, namely, *Amazonia* Theissen, *Asteridiella* McAlpine, *Pauahia* Stevens and *Prataprajella* Hosag.
2. the code does not distinguish the morphology of the head cells of the appressoria
3. the code does not distinguish the position of the phialides

In short, Beeli formula is useful in assembling similar species, but it does not separate the taxa with clear demarcation

To overcome these difficulties and to incorporate the newly described genera *Endomeliola* Hughes & Pirozynski, *Pauahia* Stevens and *Prataprajella* Hosag., the Beeli's digital formula has been completely modified here.

The digital formula proposed here consists of three groups of digits. The first group of four digits distinguishes all the genera

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using eleven characters. The second group of five digits uses nineteen characters to denote arrangement of appressoria, the morphology of the head cells of appressoria, location of the phialides in the colony, morphology of the mycelial setae and septation of ascospores. The third group of five digits uses twenty three characters. Appressoria are mostly borne just below the septum and can be distinguished based on the distance between appressoria, which determines whether the appressoria are crowded or sparsely arranged. Length and width of ascospores, diameter of perithecia and length of the mycelial setae are also important. Taxa can be further distinguished by noting for instance the position of the colony on the host, the nature of the colony, the morphology of mycelium, branching pattern, shape of the cells of appressoria, pattern of distribution of setae, ascospore shape.

I – Group (generic characters)

(1) Mycelium
- 1 ... endophytic (*Endomeliola*)
- 2 ... ectophytic

(2) Ascomata
- 1 ... stromatic (*Pauahia*)
- 2 ... flattened-globose and in or with radiating mycelium (*Amazonia*)
- 3 ... globose

(3) Mycelial setae
- 0 ... absent
- 1 ... present (*Meliola*)

(4) Setae and appendages of Ascomata
- 0 ... absent (*Asteridiella*)
- 1 ... with larviform appendages (*Appendiculella*)
- 2 ... with setae (*Irenopsis*)
- 3 ... with setae and appendages (*Prataprajella*)

II – Group (morphology of appressoria, mycelial setae and position of phialides)

(1) Appressoria (capitate hyphopodia)
- 1 ... alternate and /or unilateral
- 2 ... opposite
- 3 ... alternate and opposite

(2) Head cells of appressoria
- 1 ... entire
- 2 ... angulose to slightly lobate
- 3 ... sublobate to deeply lobate

(3) Phialides (Mucronate hyphopodia)
- 1 ... mixed with appressoria
- 2 ... borne on a separate mycelial branch

(4) Mycelial setae
- 0 ... absent
- 1 ... simple, straight, acute to obtuse at the tip
- 2 ... simple, uncinate to coiled
- 3 ... dentate or shortly furcate (>30 μm)
- 4 ... branched and the branchlets diverged
- 5 ... simple and dentate
- 6 ... simple and branched or furcate

(5) Ascospores
- 1 ... 1-septate

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2 ... 2-septate
3 ... 3-septate
4 ... 4-septate

III – Group (measurements)

(1) Length of mycelial cells
1 ... up to 10 µm
2 ... 11–20 µm
3 ... 21–30 µm
4 ... 31–40 µm
5 ... 41 µm and above

(2) Length of ascospores
1 ... up to 20 µm
2 ... 21–30 µm
3 ... 31–40 µm
4 ... 41–50 µm
5 ... 51–60 µm
6 ... 61 µm and above

(3) width of ascospores
1 ... .up to 10 µm
2 ... 11–20 µm
3 ... 21–30 µm
4 ... 31 µm and above

(4) Diameter of Ascomata
1 ... up to 100 µm
2 ... 101–200 µm
3 ... 201–300 µm
4 ... 301 µm and above

(5) Length of setae
0 ... setae absent
1 ... up to 300 µm
2 ... 301–500 µm
3 ... 501–1000 µm
4 ... 1000 µm and above.

The first four digits allow one to distinguish genera as shown below:

1300 – *Endomeliola*
2100 – *Pauhia*
2200 – *Amazonia*
2300 – *Asteridiella*
2301 – *Appendiculella*
2302 – *Irenopsis*
2303 – *Prataprajella*
2310 – *Meliola*

As an example, let's describe the first species in the Hansford's Monograph with the digital formula.

Asteridiella crustacea (Speg.) Hansf., Sydowia 10: 47, 1957. Hansf., Sydowia, Beih. 2: 26, 1961.

Colonies epiphyllous, up to 1.5 mm in diameter. – Hyphae substraight to undulate, branching opposite, acute, densely reticulate and subsolid, cells 15–20 × 10–12 µm. – Appressoria alternate, antrorse, straight or slightly bent, mostly 30–35 µm long; stalk cells cuneate, 6–14 µm long; head cells clavate with crenate to sublobate margin, 20–25 × 12–18 µm. – Phialides numerous in some colonies, rare in others, mixed with appressoria, opposite or alternate, ampulliform, 22–30 × 8–10 µm, neck elongated. – Perithecia scattered, verrucose, up to 290 µm in diameter, perithecial wall cells rounded to obtusely conoid, up to 15 µm high. – Ascospores ellipsoidal, obtuse, 4-septate, constricted at the septa, 60–75 × 30–34 µm.

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On leaves of *Drimys* sp., Brazil, Puiggari, type (SPEG).

This description converts into the digital formula as:

2300.12104. 26430 Colonies epiphyllous, dense; hyphae substraight to undulate, closely reticulate and subsolid; appressoria antrorse, 30–35 µm long . . . . . *Asteridiella crustacea*

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