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Contributions to the Geographical Expansion of Two Niaceae Members (*Flagelloscypha minutissima* and *Merismodes anomala*) in Türkiye

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Abstract: During field studies carried out in Bingöl and Hakkâri provinces of the Eastern Anatolia Region, two cyphelloid macrofungi species, *Flagelloscypha minutissima* and *Merismodes anomala*, belonging to the family Niaceae, were identified based on morphological characteristics. These species are noteworthy due to their infrequent reports in Türkiye and the absence of detailed morphological or ecological records in the literature. *F. minutissima* was found to have developed on the decayed *Populus* branch, while *M. anomala* was found to have developed on the decayed *Quercus* branch. The identification of the species was based on a combination of macroscopic features and microscopic characters, including the basidium, basidiospores, marginal cells and hyphal system. A detailed morphological analysis was conducted, supported by descriptive measurements. Taxonomic positions were confirmed using online databases. The findings presented herein constitute novel localities for the mycobiota of Türkiye for both species, thereby providing original contributions regarding the ecological roles and biodiversity of small-sized Basidiomycota members growing on broad-leaved tree remains.

Keywords: Agaricales, cyphelloid fungi, Niaceae, New locality, Türkiye

İki Niaceae Üyesinin (*Flagelloscypha minutissima* ve *Merismodes anomala*) Türkiye'deki Coğrafi Yayılımına Katkıları

Öz: Doğu Anadolu Bölgesi'nin Bingöl ve Hakkâri illerinde gerçekleştirilen arazi çalışmaları sırasında, Niaceae familyasına ait iki cyphelloid makrofungus türü olan *Flagelloscypha minutissima* ve *Merismodes anomala* morfolojik karakterlere dayalı olarak teşhis edilmiştir. Bu türler, Türkiye'de oldukça nadir raporlanmış olmaları ve literatürde detaylı morfolojik veya ekolojik kayıtlarının bulunmaması nedeniyle dikkate değerdir. *F. minutissima* çürümüş Kavak dalı üzerinde, *M. anomala* ise çürümüş Meşe dalı üzerinde gelişmiş olarak tespit edilmiştir. Türlerin teşhisinde, makroskobik özelliklerin yanı sıra bazidiyum, bazidyospor, kenar hücreleri ve hifa sistemi gibi mikroskobik karakterler temel alınmış; tanımlayıcı ölçümlerle desteklenen ayrıntılı morfolojik analizler gerçekleştirilmiştir. Taksonomik konumlar çevrimiçi veri tabanları kullanılarak doğrulanmıştır. Bu bulgular, her iki tür için de Türkiye mikobiyotasına ait yeni lokalite kayıtları sunmakta; geniş yapraklı ağaç kalıntıları üzerinde gelişen küçük boyutlu Basidiomycota üyelerinin ekolojik rolleri ve biyoçeşitlilik içindeki yerleri hakkında özgün katkılar sağlamaktadır.

Anahtar Kelimeler: Agaricales, Sifelloid mantarlar, Niaceae, Yeni lokalite, Türkiye



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Introduction

Niaceae, which is classified within the order *Agaricales*, encompasses cyphelloid fungi. Cyphelloid fungi are distinguished by their small, disc-, tube-, or cup-shaped fruiting bodies, which typically live saprotrophically on woody materials. The family, whose type genus is *Nia*, comprises 10 genera and 278 species, including genera such as *Flagelloscypha*, *Lachnella*, *Merismodes*, *Woldmaria*, *Halocyphina*, *Calathella*, *Cyphellopsis*, *Maireina*, and *Digitatispora* (Kirk et al., 2008; Silva-Filho et al., 2023). Members of the *Niaceae* family are typically diminutive in stature and characterised by a delicate structural composition. The cap and stem structures may be indistinct or completely absent. In certain species, the fruiting bodies are characterised by hairy or bristly structures. These morphological characteristics are of significant importance for species identification. *Niaceae* is distinguished by its saprotrophic lifestyle, a feature that sets it apart from other plant families. These organisms characteristically thrive on decaying wood, leaf litter, and other organic materials. This characteristic is pivotal in their role in facilitating the cycling of organic matter within forest ecosystems. Furthermore, some species have been observed to inhabit saline environments, thereby demonstrating their ecological flexibility (Donk, 1951; 1959; Bodensteiner et al., 2004; Silva-Filho et al., 2023). Cyphelloid fungi are recognised for their polyphyletic origins, characterised by the presence of similar morphologies despite distinct evolutionary origins. However, the family *Niaceae* is considered a monophyletic group, a notion supported by molecular phylogenetic studies. This family has been consolidated within the order *Agaricales* by analyses of gene regions such as LSU and ITS (Bodensteiner et al., 2004).

The primary objective of this study is to present detailed morphological identifications and ecological observations of *Flagelloscypha minutissima* (Burt) Donk and *Merismodes anomala* (Pers.) Singer, which belongs to the family *Niaceae*. These were identified during field studies in Bingöl and Hakkâri provinces. To contribute to the macrofungal diversity of Türkiye and to complete missing taxonomic information, *F. minutissima* has been reported from Türkiye only in the studies of Sesli & Denchev (2008, Gezer-Denizli), Öder (1988, Konya) and Kaya et al. (2014, Gaziantep) (Figure 1). The first documented report of *M. anomala* was made by Pilát (1933, Kastamonu), who discovered it in Anatolia. In subsequent years, it was included in checklist studies, such as those by Sesli et al. (2020), and Çetinkaya et al. (2021, Karaman) (Figure 1). However, the paucity of data

is evident in the absence of detailed field data, descriptive morphological information, and ecological details. These novel samples, obtained from Bingöl and Hakkâri in 2025, not only provide new locality records but also fill the knowledge gap about Türkiye's mycobiota by documenting the current presence of species with detailed descriptions and making an original contribution to national biogeographic databases. In addition, when some studies conducted in Bingöl and Hakkâri in recent years (Uzun et al., 2009; 2013; 2017; Acar et al., 2018; 2020; Kalmer et al., 2018; Acar, 2023; Akçay et al., 2023) are examined, the species in question are new records for these provinces.

Materials and Methods

Field studies were conducted in the provinces of Bingöl (Central) and Hakkâri (Şemdinli) in April and May 2025. Samples were collected by observing *Quercus* sp. and *Populus* sp. branches. Samples obtained from each locality were meticulously documented, including the recording of GPS coordinates and detailed habitat information. Following collection, the samples were transferred to the laboratory where they were dried at approximately 25°C. They were then stored in labelled polyethylene bags and converted into fungarium material for subsequent analysis. The morphological description commenced with an evaluation of the macroscopic features, followed by a detailed microscopic examination. The micromorphological analyses were conducted using a Leica DM500 light microscope. During this process, primary structures, including basidia, basidiospores, and cystidia, were meticulously examined, and high-resolution digital images were obtained. At least 30 replicates were taken from each structure. Measurements were carried out using Leica Application Suite v3.4.0 software, thus obtaining reliable size ranges. To support species identification, micromorphological drawings were converted into scientific illustrations using CorelDRAW (64-bit) graphics software. Identification of the study specimens was made taking into account the diagnostic keys suggested by Singer (1949), Breitenbach & Kränzlin (1986), Bodensteiner et al. (2004), Piatek & Cabala (2004), Anonymous (2025) and Yang et al. (2025) and the descriptive literature. The color catalogue of Cléménçon et al. (2012) was used to describe the colors of the macrofungi accurately. After the identification process was completed, all examined specimens were archived as fungarium material in the VANF Fungarium, located within the Department of Biology at the Faculty of Science of Van Yüzüncü Yıl University, for permanent storage.

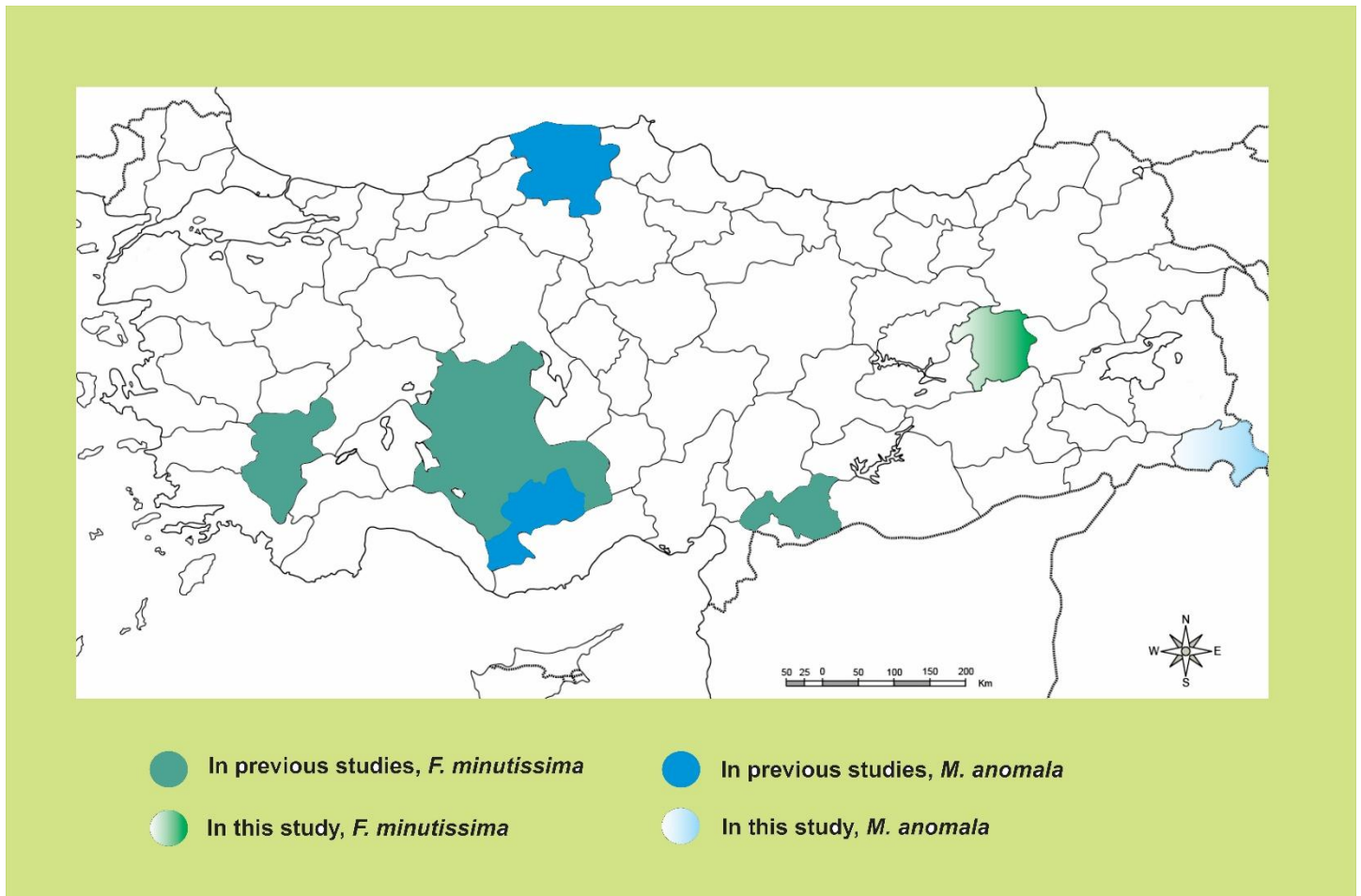


Figure 1. Geographic distribution of study samples in Türkiye

Results

The identification of the taxa *Flagelloscypha minutissima* and *Merismodes anomala* was achieved through the evaluation of samples obtained from field studies. The present study incorporates concise morphological descriptions of macrofungi, accompanied by photographic documentation captured in their natural environment. Illustrative drawings have also been provided to depict their microscopic characteristics. The systematic positions of the species have been established in accordance with the MycoBank and Index Fungorum databases.

Flagelloscypha Donk

Flagelloscypha minutissima (Burt) Donk (Figure 2–3)

Basidiomata 0.2–1 mm in diam., cupulate to discoid or shallowly funnel-shaped, sessile or subsessile. Margin incurved when young, later straight or slightly reflexed. Hymenial surface smooth, dry, greyish white to pale cream, often finely farinose under magnification.

Outer surface finely hairy to woolly, white to pale in colour. Margin densely covered with thick-walled, crystal-encrusted setiform cells. Context fragile, thin, whitish. Odor and taste indistinct. Spore print white. **Basidia** 20–30 × 5–6.5 µm, narrowly clavate to cylindric, hyaline, 2-sterigmata, with basal clamp connections. **Basidiospores** (7–) 7.8–9 (–10) × (3.5–) 4–4.5 µm, ellipsoid to navicular or lacrymoid, smooth, thin-walled, hyaline, non-amyloid, usually guttulate, with a distinct apiculus. **Marginal hairs** abundant on the hymenial margin, terminal cells thick-walled, cylindric to subclavate, often encrusted with sharp crystals; tips thin and needle-like, sometimes not encrusted. **Hyphal system** monomitic, composed of generative hyphae 2–4 µm wide, thin-walled, hyaline, with clamp connections throughout.

Specimens examined: Türkiye, Bingöl, central district, Ovarpark houses vicinity, 38° 51'25"N, 40° 32'00"E, 1041 m, on branch of *Populus* sp., 04.05.2025, Acar 2085.

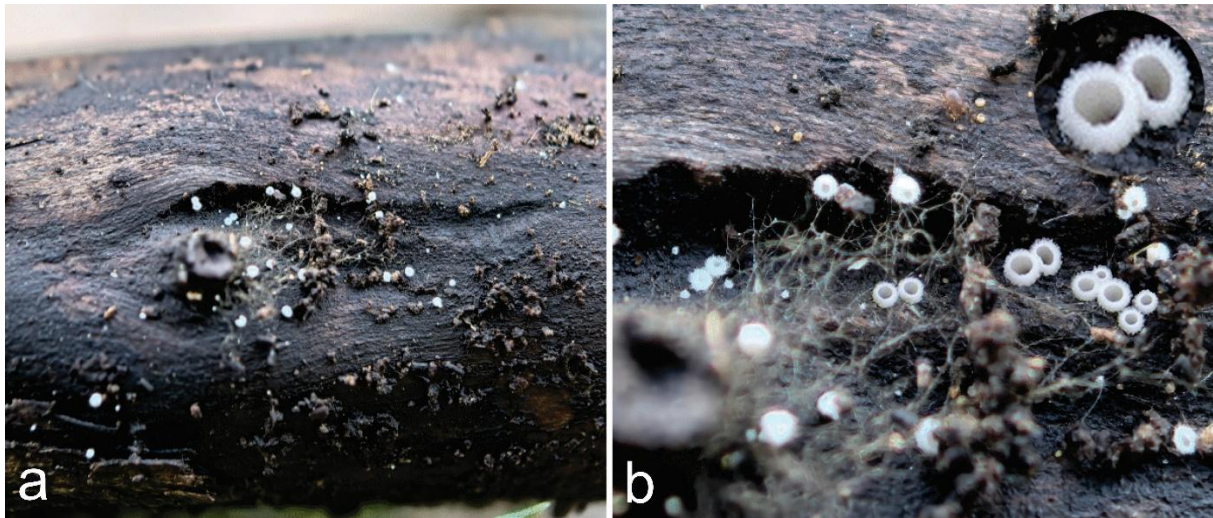


Figure 2. *Flagelloscypha minutissima* a-b. Basidiomata in natural habitat (on branch of *Populus* sp.)

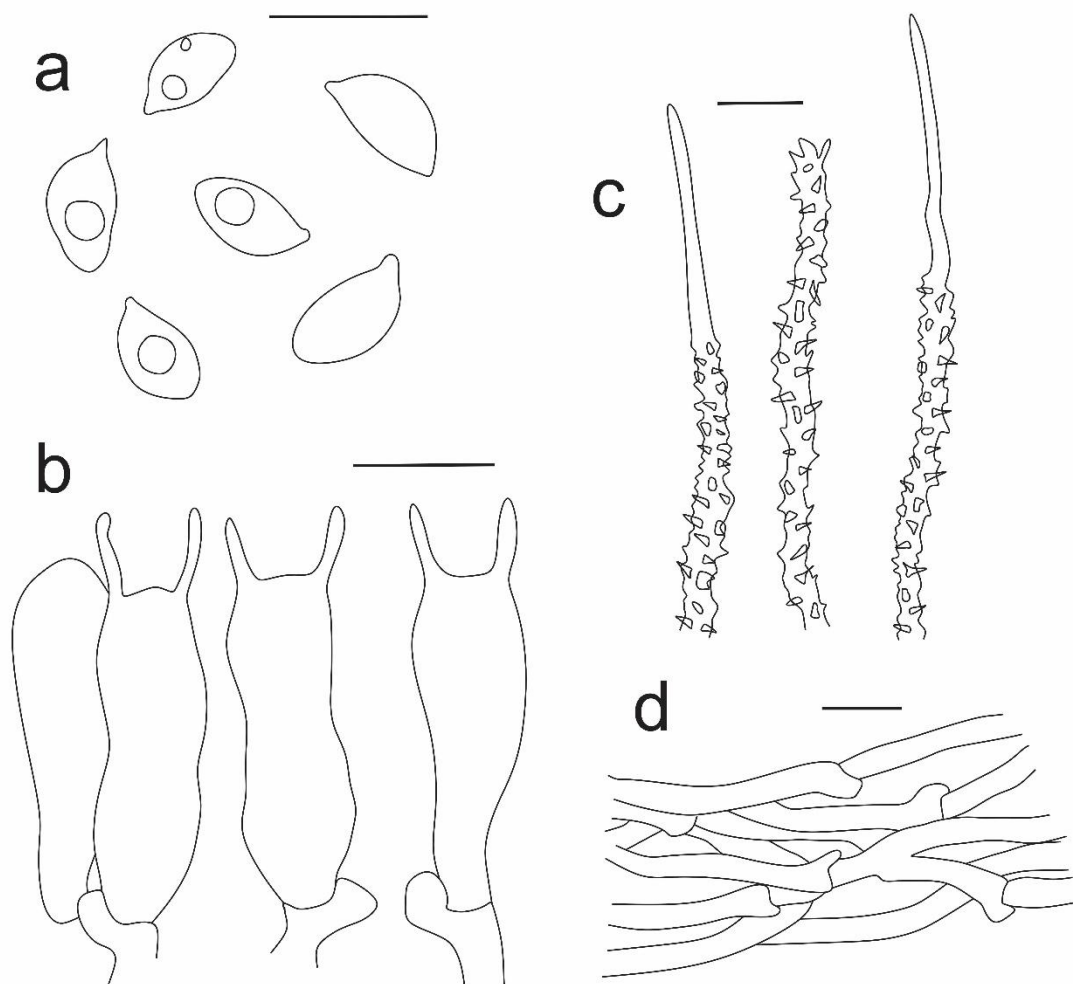


Figure 3. *Flagelloscypha minutissima* a. spores, b. basidia, c. marginal hairs, d. hyphae
Scale bars: 10 μ m

Merismodes Earle**Merismodes anomala** (Pers.) Singer (Figure 4–5)

Basidiomata 0.2–1.0 mm in diam., cupulate to urn- or shallowly saucer-shaped, sessile or sessile, typically gregarious to densely cespitose, sometimes coalescing to cover decimeters of substrate. Margin entire, cream-colored, incurved when young, later straight or slightly reflexed, often appearing floccose due to exserted marginal hairs. Hymenial surface smooth, dry, cream to ochre, sometimes dull cinnamon, soft when fresh, becoming corneous and hard when dry. Under magnification, surface may appear finely farinose. Outer surface tomentose, appressed, composed of closely spaced, light brown hairs. Context thin, fragile, whitish. Odor and taste indistinct. Spore print white (inferred). **Basidia** 25–40 × 5–6.5(–7) µm, slenderly clavate, thin-walled, hyaline, with four sterigmata and a basal clamp connection. **Basidiospores** (8–)8–9.5(–10) × (3.7–)4–

5(–6.5) µm, elliptical to slightly allantoid, smooth, thin-walled, hyaline, non-amyloid, guttulate, with a distinct apiculus. **Marginal hairs** abundant, forming a conspicuous floccose fringe; hairs brown, thick-walled, upper half encrusted with coarse crystals, 2–4 µm wide, clavate at the apex and thickened up to 6 µm, lighter than the base, with entire length up to 150 µm. **Hyphal system** monomitic. **Generative hyphae** 1–2 µm wide, thin-walled, hyaline, septate, with clamp connections. Subhymenium composed of compact, short-celled hyphae; subiculum formed of loosely interwoven, broader hyphae, sometimes slightly pigmented.

Specimens examined: Türkiye, Hakkâri, Şemdinli, Öveç Village, Karakaş Hamlet, 37° 21'43"N, 44° 31'03"E, 1547 m, on branch of *Quercus* sp., 25.04.2025, Acar 2073.

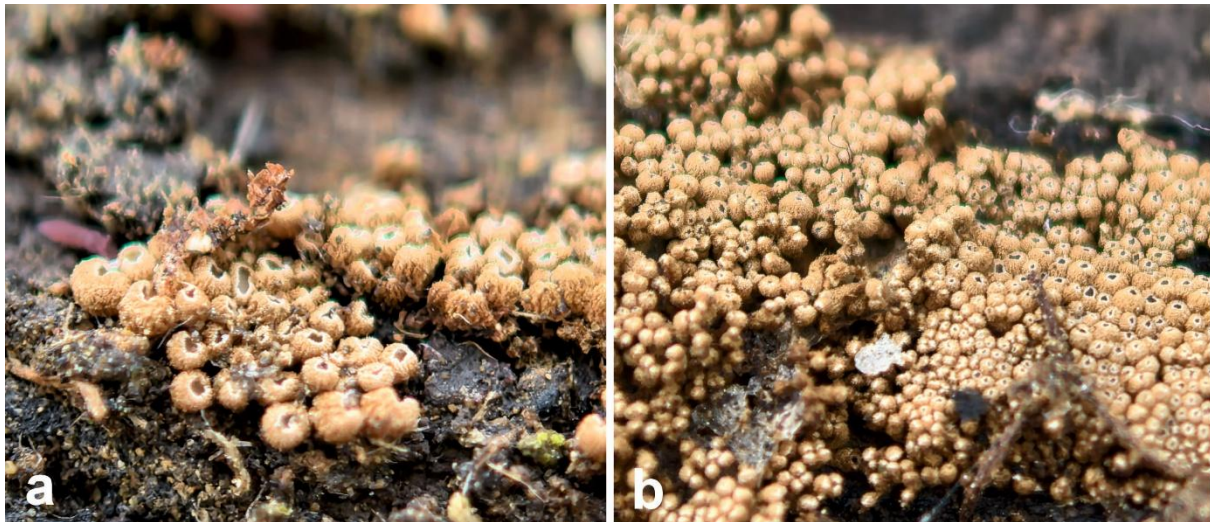


Figure 4. *Merismodes anomala* a-b. Basidiomata in natural habitat (on branch of *Quercus* sp.)

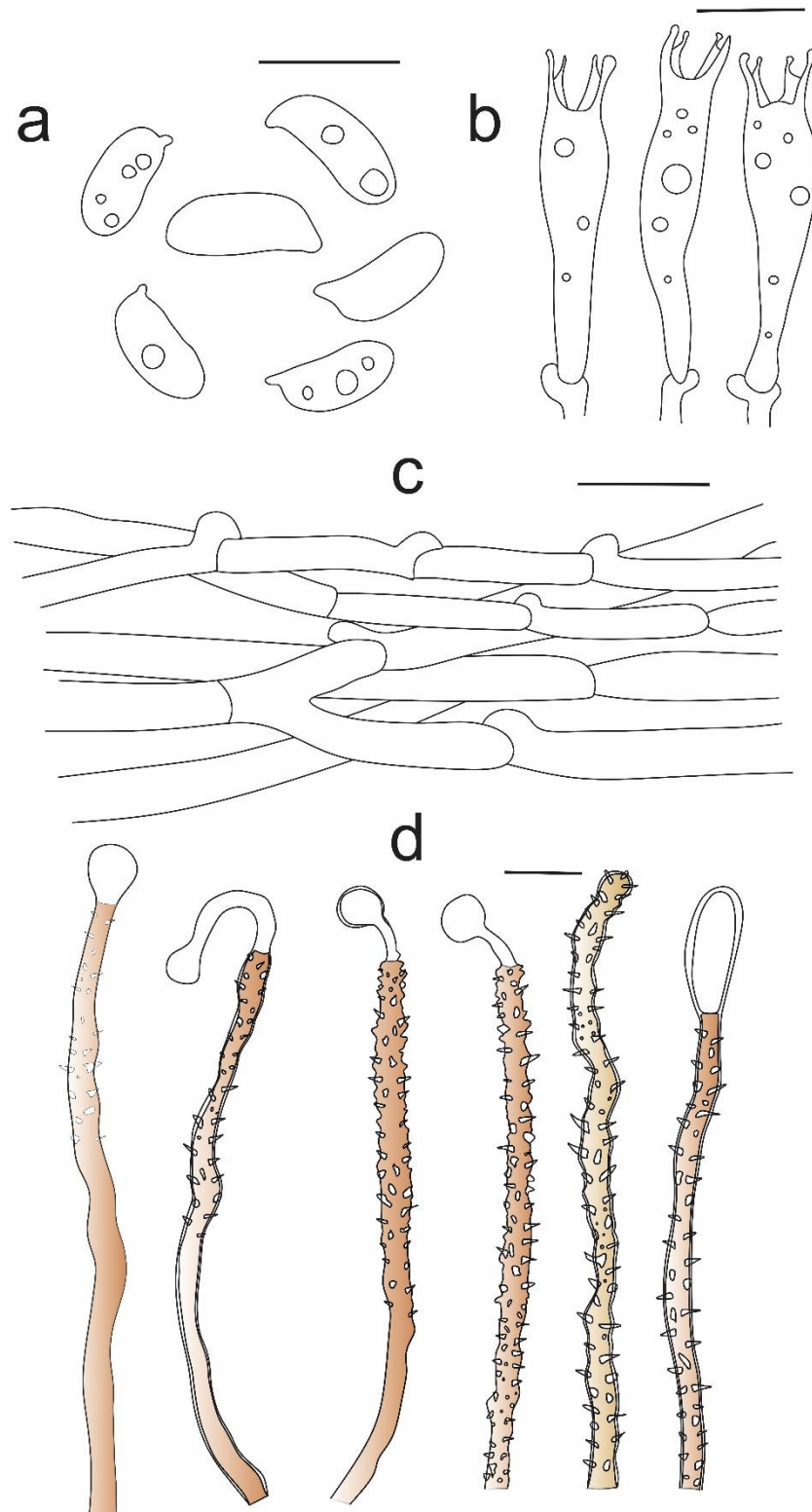


Figure 5. *Merismodes anomala* a. spores, b. basidia, c. hyphal system, d. Hairs
Scale bars: 10 µm

Discussions

In this study, *Flagelloscypha minutissima* and *Merismodes anomala*, collected from Bingöl and Hakkâri provinces, are reported as new localities belonging to the Turkish mycobiota. Both species are notable for their small, cyphelloid basidiomata, which belong to the *Niaceae* family. Previous records of these species from Türkiye are quite limited and lack detailed morphological data. In this respect, the present study addresses a significant lacuna in the extant literature by providing reliable micromorphological parameters for the identification of both species. In accordance with its species name, *Flagelloscypha minutissima* is distinguished by its relatively diminutive basidiomata (0.2–1 mm in diameter) and is particularly distinguished by its setiform, crystalline marginal cells. Structurally, this species can be distinguished from similar species such as *Flagelloscypha ulei*, *F. pilatii*, and *F. oblongispora*. However, the larger basidiospores of *F. ulei* (11–14 × 5–6 µm) and the larger, sometimes ornamental, spores of *F. pilatii* are distinguishing features (Piątek & Cabala, 2004). The thin-walled, guttulate structure with a prominent apicule of *F. minutissima* spores (7.8–9 × 4–4.5 µm), as well as the narrow, short basidia (20–30 × 5–6.5 µm), are important diagnostic criteria. The presence of densely distributed setiform cells along the margin, covered with sharp crystals, is a distinguishing characteristic that differentiates this species from other members of *Flagelloscypha* (Singer, 1951; Piątek & Cabala, 2004). *Merismodes anomala* is a frequently encountered taxon in the literature; however, its considerable morphological diversity can make it challenging to diagnose. It is frequently misidentified, being erroneously compared with species such as *Merismodes fasciculata*, *M. clavus*, and *M. cingulifera*. However, the distinguishing features of *M. anomala* include the light brown, thick-walled marginal setae, which are covered with crystals at the tip and can extend up to 150 µm. Furthermore, the smooth-surfaced, slightly ellipsoidal, and guttulate structure of the basidiospores (8–9.5 × 4–5 µm) are important for diagnosis (Breitenbach & Kränzlin, 1986). The basidia (25–40 µm) and the presence of four sterigmas are also consistent with the morphological range defined for *M. anomala* in the extant literature. The distinctive features that set this species apart from similar ones include the

presence of a floccose margin and a tomentose outer surface (Singer, 1975). From an ecological perspective, both species are characterised by their saprotrophic growth patterns, which involve the utilisation of decaying material from deciduous trees as a nutrient source. The documented occurrence of *F. minutissima* on *Populus* sp. and *M. anomala* on *Quercus* sp. indicates a potential species-specific affinity for certain tree species. However, the frequent oversight of small cyphelloid species endemic to such microhabitats suggests that their true dispersal potential may be much greater than previously estimated (Bodensteiner et al., 2004; Silva-Filho et al., 2023). Distinctions can be made between species of the *Niaceae* family, particularly in terms of the structure of the margin, the morphology of the marginal setae crystals, the size of basidiospores, and the structure of basidia. The observation that both species possess a monomitic hyphal system, characterized by septate and clamp-connected hyphae, is consistent with the prevailing characteristics of the family. However, in *F. minutissima*, the hyphae are thicker (2–4 µm) and the outer surface is more woolly, while in *M. anomala*, these structures are more compact and tomentose. Furthermore, discrepancies in the subhymenium and subiculum have been demonstrated to contribute to the process of morphological identification (Silva-Filho et al., 2023).

In conclusion, this study updates the distribution of both *Flagelloscypha minutissima* and *Merismodes anomala* in Türkiye, contributing to their morphological characterization and detailing their distinguishing features in relation to similar species. A detailed analysis of the limited records in the literature will form the basis for further research on the biogeography and systematics of such cyphelloid species.

Conflicts of interest

The author declare no competing interests.

Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited (İsmail ACAR).

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