

Acarospora contigua (Acarosporaceae, Ascomycetes), a Lichenized Fungus new to India

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ABSTRACT

Acarospora contigua H. Magn., is reported here as new record to India collected from Eastern Ghats of India. It is characterized by bright greenish-yellow, squamulose, non-effigurate, non-placodioid thallus and immersed, indistinctly marginate apothecia, multi-spored asci and simple, ellipsoid to oblong ascospores. All other Indian species within the genus *Acarospora* has temperate distribution while *A. contigua* grows in tropical conditions between altitude ranges of 500–1000m. Including *A. contigua* a total of 14 species of *Acarospora* are known from India and key for their identification is provided.

INTRODUCTION

The lichen genus *Acarospora* A. Massal., is a cosmopolitan genus comprised of 200 species worldwide (Knudsen et al. 2008; Lücking et al. 2017), which accommodates species having different shades of color like grey, brown and yellow, with aspicilioid or pseudo-lecanorine apothecia, multispored asci with a non-amyloid tholus and simple hyaline ascospores (Knudsen, 2007; Reeb et al. 2007). Awasthi (1991) keyed out 13 species of *Acarospora* from the Indian subcontinent occurring in the Himalayas. Singh and Sinha (2010) listed nine species under *Acarospora*. Recently, Sinha et al. (2018) listed 10 more species of *Acarospora* as new records to India based on published literature. However, after the nomenclatural update, the genus *Acarospora* now comprises 14 species. The remaining species are transferred under *Glypholecia* and *Silobia* with single species each, while *Pleopsidium*, *Myriospora* and *Sarcogyne* have two species (Awasthi, 2007; Knudsen 2007; Singh and Sinha, 2010; Sinha et al. 2018).

The Eastern Ghats and Deccan Plateau region of India (Singh and Sinha, 1997) is gaining importance for lichenological studies in recent times and new taxa are being reported very often. Nayaka et al. (2013b, a) reported two new species of *Pyxine* with yellow medulla and *Peltula farinosa* Büdel as a new record for India; Mohabe et al. (2016b, 2015a, b) described *Diorygma kurnoolensis*

Mohabe, Nayaka & Reddy, *Stigmatochroma microspora* Mohabe, Nayaka & Reddy, *Graphis neeladriensis* Mohabe, Nayaka & Anjali as new to science; Mohabe et al. (2018) reported saxicolous pyrenocarpous species *Thelopsis isiaca* Stiz. as new to India. Anjali et al. (2013) Mohabe et al. (2014), (2016a), (2017), Nayaka et al. (2013 b), and Reddy et al. (2011) also provided other new distributional records of lichens for the state of Andhra Pradesh (Fig. 1). In our ongoing exploration of India's Eastern Ghats, several interesting lichen specimens are collected, of which few specimens identified as *Acarospora contigua* is communicated here as new record to India (Fig. 2).

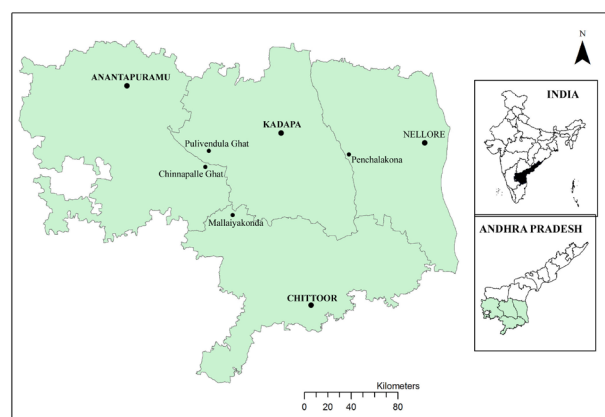


Fig. 1. Map showing distribution of *Acarospora contigua* in different districts of Andhra Pradesh.

MATERIALS AND METHODS

The external morphology of the *Acarospora* specimens was studied under Leica S8APO stereo-zoom microscope, while anatomical characters of the thallus, pycnidia and apothecia were observed under Leica DM500 compound microscope. The thin hand-cut sections of the thallus and apothecia were initially mounted in water to record various structures' color and measurements. The apothecial sections were then observed after applying aqueous 10% KOH solution, while Lugol's solution (CDH, New Delhi) was used for iodine reactions. The color tests were performed by using routine reagents; aqueous solution of KOH (K), calcium hypochlorite (C), and *para*-phenalene-diamine (P) and TLC was performed in solvent system A following Walker and James (Walker and James, 1980). A voucher specimen is deposited at CSIR-National Botanical Research Institute, Lucknow (LWG) Uttar Pradesh, and other specimens are deposited at Plant & Lichen Herbarium, Department of Botany, Yogi Vemana University, Kadapa, Andhra Pradesh.

THE NEW RECORD

Acarospora contigua H. Magn., Mycologia 21:256 (1929)

Thallus saxicolous, squamulose; squamules aggregated, contiguous to dispersed as clumps, areolate to cracked; upper surface lemon yellow to greenish-yellow, bright, smooth, epruinose; areolae 0.3–1.5 mm wide, flat to concave, rarely convex, mostly angular in shape, lobate at the periphery, but not effigurate; lobes 0.08–0.2 mm wide, margin smooth; lacking isidia and soredia; lower surface pale brown to brown; thallus 150–225 µm thick, corticated; the outermost layer of the cortex (epinecral layer) yellowish



Fig. 2. Habitat of *A. contigua* (yellowish green patches) in Thamballapalle; on the way to Mallaiyakonda. The black rocks are dominated by *Caloplaca cinnabarina* (Ach.) Zahlbr. (orange lichen) and Caliciaceae members belonging to genus *Buellia* (whitish grey patches).

to golden brown, 22–41 µm thick, prosoplectenchymatous; inner cortex hyaline, lacking crystals, 15–25 µm thick; photobiont a green alga, 50–70 µm thick; medulla hyaline, 56–88 µm thick (Fig. 3).

Apothecia immersed in the squamules with depression, rarely at level with the thallus, 1–3 apothecia per squamule, 0.1–0.3 mm in diam; rounded to oblong, occasionally irregular in shape; disc yellowish to pale brown, flat to concave, epruinose; margin absent or poorly developed, indistinct in section, but marginal area is differentiated by fine dark line, very rarely margin rises slightly above the thallus and marginal constriction can be seen in section; true exciple hyaline or indistinct; algal cells present in continuous layer around apothecia; epihymenium golden yellow to brownish, 10–30 µm thick; hymenium hyaline, interspersed with oil globules, K/KI+ blue, 65–75 µm high; hypothecium hyaline, 32–51 µm high; paraphyses septate, adglutinated, branched and anastomosing, swollen at apices; asci *Acarospora*-type, with poorly developed tholus, up to 5 µm in size, multispored (60–80) ascospore (–100), 45–55 × 10–20 µm; ascospores hyaline, simple, ellipsoid to oblong, 2.5–5.0 × 1.5–2.5(–3) µm in size.

Pycnidia sunken, punctiform, ostiole yellow-brown; conidia ellipsoid.

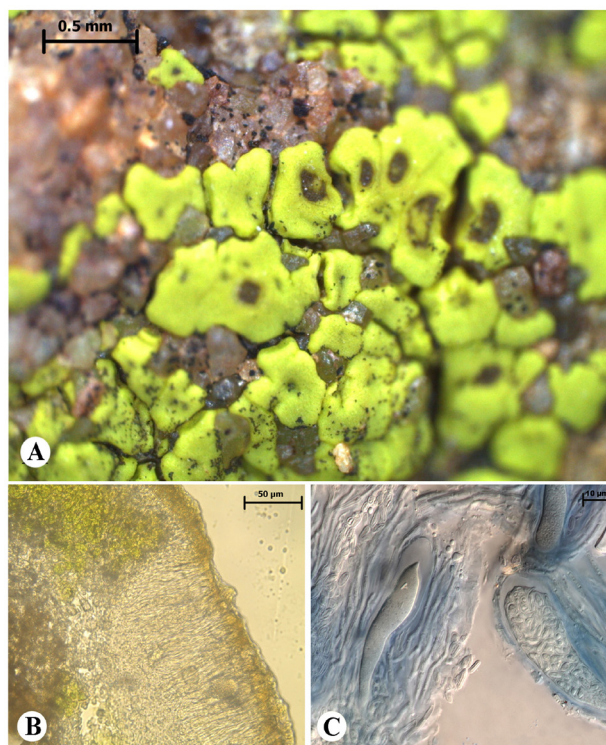


Fig. 3. *A. contigua* 2571 (LWG) **A.** Habit, **B.** Transverse section of apothecium, **C.** Ascospores within the ascus. Scale Bars: A=0.5 mm, B=50 µm, C=10 µm.

Chemistry. Thallus & medulla K–, C–, KC–, P–; TLC: Rhizocarpic acid present.

Ecology and distribution: *Acarospora contigua* found growing luxuriantly over the vertical face of exposed sandy rocks in hillocks of the Eastern Ghats in Andhra Pradesh between altitude ranges of 500–1000 m. The site has the vegetation of the dry deciduous forest. The species is found growing in association with *Caloplaca cinnabarina* (Ach.) Zahlbr., *Lecanora*, *Buellia* and other species. At present the species is distributed in different forest areas of four districts viz: Anantapuramu, Chittoor, Nellore, and YSR Kadapa district in Andhra Pradesh.

Remarks: The lichen genus *Acarospora* resembles to *Pleopsidium* Körb., which is segregate of *Acarospora*, and accommodates species having bright yellow, squamulose – effigurate thallus, asci with an enlarged axial body and broadened ocular chamber (Hafellner 1993, 1995). Knudsen et al. (2008) caution not to assume every yellow placodioid specimens to be *Pleopsidium* as there are few effigurate, yellow *Acarospora* species. *Acarospora* is distinguished from *Pleopsidium* by having non-effigurate thallus (squamulose), *Acarosproa*-type asci with narrow ocular chamber and non-amoioid tholus (I–). *Pleopsidium* contain well developed amoioid tholus, wide ocular chamber and axial mass which may I+ blue at least in the lower half of the expanded tholus than as well *Myriospora* differs due to K/I+ blue tholus and laminated thallus with an epinecral layer (Knudsen 2007). *Acarospora* again distinguish from other segregated genera by their specific characters where *Glypholecia* morphologically vary with compound apothecia, subfoliose and umbilicate thallus (Ryan 2002) furthermore *Sarcogyne* differs by their endolithic nature of thallus and lecidine apothecia (Knudsen and Standley, 2007) while *Silobia* is mainly characterized by the broken algal layer, which is disrupted at irregular intervals by bundles of medullary hyphae reaching the cortex above the algae (Westberg et al. 2011).

Acarospora contigua is characterized by non-effigurate, non-placodioid, squamulose thallus, bright greenish-yellow colour, sunken, emarginate apothecia and presence of rhizocarpic acid. The squamules, when closely aggregated to form a continuous patch the marginal region may appear effigurate. However it is not the true effigurate condition. The squamules in this region are mostly elongate and lobate. The apothecia lack a distinct margin, but the marginal area is differentiated by thin dark line. Very rarely the slightly raised margin can be seen. Sometimes when the squamules are squeezed between the grains of the rock or when it is growing in crevices the thallus gets folded to give a margin like appears to apothecia. In such cases

the margin can be seen as constriction in vertical section. In most of cases continuous layer algal cells can be seen around the apothecial section.

Acarospora contigua resembles to *A. socialis* H. Magn. with respect to thallus morphology, chemistry and multi-spored ascus but *A. socialis* distinguished by having lobed areoles and squamulose, more than 100 ascospores in ascus, globose pycnidia and ellipsoid to short bacilliform conidia. Other greenish-yellow Indian species within the genus *Acarospora* has temperate distribution in India.

Distribution: Earlier this species is known from western North America and Mexico, it is now a new record for India.

Specimens examined: India, Andhra Pradesh, YSR district, Pulivendula Ghat, alt. ca. 450 m, near to Thummalapalli Uranium Mine, on a sandy rock, 07.09.2012, Satish Mohabe, A. Madhusudhana Reddy and Anjali Devi B. 2230; Anantapuramu district, Chinnapalle Ghat, alt. ca. 577 m., on a sandy rock, 07.11.2012, Anjali Devi B. & Satish Mohabe 2571 (LWG). Chittoor District, Thamballapalle, on the way to Mallaiyakonda (Yenugu Mallama Temple), alt. ca. 687 m, on black rock, 05.01.2013, A. Madhusudhana Reddy and Satish Mohabe 2744; Nellore District, Penchalakona, beside Narasimha Swamy Temple alt. ca. 1000m, on exposed rock, 07.12.2018, Satish Mohabe 7379.

An updated key to *Acarospora* from India

1. Thallus terricolous, greenish yellow *A. schleicheri* (Ach.) A. Massl.
- 1a. Thallus saxicolous, differently colored 2
2. Thallus whitish-grey, dirty white, reddish brown and brown black..... 3
- 2a. Thallus dark green, greenish yellow, lemon yellow. 13
3. Cortex C+ red, gyrophoric acid present..... 4
- 3a. Cortex C-, gyrophoric acid absent 5
4. Thallus greenish to dark brown, distinctly lobate at periphery *A. bullata* Anzi
- 4a. Thallus reddish brown to dark brown, squamulose-areolate *A. fuscata* (Ach.) Arnold
5. Thallus/squamules pruinose..... *A. strigata* (Nyl.) Jatta
- 5a. Thallus/squamules epruinose 6
6. Apothecia punctiform *A. superans* H. Magn.
- 6a. Apothecia otherwise 7
7. Epithecium pale, yellowish or reddish brown..... 8
- 7a. Epithecium dark brown or black 10
8. Epithecium yellowish brown9
- 8a. Epithecium reddish brown, hymenium 65–100 (–125)

- µm high *A. veronensis* A. Massal.
 9. Thallus reddish brown, hymenium 60–85 µm high
 *A. badiofusca* (Nyl.) Th. Fr.
 9a. Thallus brown black, hymenium 85–100 µm high
 *A. tominiana* H. Magn.
 10. Epithecium black, 80–100(–125).....*A. sordida* Wedd.
 10a. Epithecium dark brown 11
 11. Hymenium more than 125 µm high
 *A. obpallens* (Nyl. ex Hasse) Zahlbr.
 11a. Hymenium less than 125 µm high..... 12
 12. Hymenium 68–80 µm high
 *A. molybdina* (Ach.) Trevis.
 12a. Hymenium more than 80 (–100) µm high
 *A. nitrophila* H. Magn.
 13. Thallus indeterminate, dark greenish-yellow, apothecia
 absent *A. angolensis* H. Magn.
 13a. Thallus determinate, bright lemon-yellow, apothecia
 present. *A. contigua* H. Magn.

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