TAXONOMIC STUDIES ON INDIAN MYXOMYCETES

V. Some New Records of Trichiales

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Seven species of myxomycetes viz. *Calomyxa metallica* (Berk.) Nieuwl, *Arcyria affinis* (Rost.) Nann.-Brem., *Arcyria gulielmae* Nann.-Brem., *Arcyria magna* Rex, *Arcyria virescens* G. Lister, *Trichia crateriforme* Martin and *T. verrucosa* Berk., are recorded from India for the first time. *A. virescens* previously described wrongly as *A. incarnata* is redescribed and illustrated.

Introduction

This paper gives an illustrated account of seven species of myxomycetes recorded for the first time from India. Four of these have exclusively been collected from Himachal Pradesh. *Arcyria virescens* G. Lister from Nainital (U.P.) was previously described wrongly as *A. incarnata* (Pers.) Pers. (Lakhanpal 1974). The specimens have been submitted to the Herbarium Mycologico, Department of Botany, University of Delhi, Delhi 110007. Duplicates of most of the specimens have also been deposited with Mrs N. E. Nannenga-Bremekamp, Doorwerth, the Netherlands.

Calomyxa metallica (Berk.) Nieuwl

[*Am. Midl. Nat.*, **4**, 335, 1916. (Fig. 1 a & b)]

Fructifications sessile, sporangiate. Sporangia, scattered, subglobose, 0.6–0.8 mm, in diameter, iridescent, purplish black; hypothallus inconspicuous; peridium single, thin, membranous, encrusted with granular matter, purplish black, wrinkled; capillitium of long, unbranched and branched threads, minutely roughened, warts arranged in a loose spiral, occasionally attached to the peridium; spore-mass brown, ochraceous in transmitted light, subglobose, strongly warted, 11–12.5 μ in diameter.

Habitat—Bark of *Cedrus deodara* incubated in moist chambers.

Specimens examined—H.P., Simla, December 1972, TNL/525.

Notes—The protoplasmodium which lacks rythmical reversible streaming of the cytoplasm, is inconspicuous in the beginning. It turns watery white later on, changing to purplish iridescent at maturity. It might move on the substratum for some distance, then it condenses at one place and swells up into a spherical mass which forms the sporangium.

Arcyria affinis (Rost.) Nann.-Brem.

[*Proc. K. ned. Akad. Wet.*, C, **71**, 31–40, 1968. (Fig. 1 c–e)]

Fructifications sporangiate, stipitate, up to 4 mm in length, increasing 2–3 times after dehiscence. Sporangia densely crowded, cylindrical, dull crimson or dark red,

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fading to dark reddish brown, drooping after dehiscence, 3–4 mm in length, peridium evanescent except for a calyculus at base and small peridial fragments here and there on the capillitial net; calyculus rather shallow, striated on the outer side, papillose within, the papillae united to form an incomplete reticulum; capillitium reddish brown in mass, loosely attached to the calyculus, highly elastic, capillitial threads branched and anastomosed forming a lax net with few free ends, threads 3–4 (–6) μ in diameter, marked with half rings and spines, joined by a network of minute ridges, swollen at places, free ends clavate or truncate, spiny, up to 6 μ in diameter; spore-mass dull crimson, hyaline in transmitted light, globose, 6–8 μ in diameter, almost smooth but marked with 5–7 scattered warts. Stipe short or long, weak, up to 1 mm in length, reddish brown, filled with spore-like cells, 9–15 (–17) μ in diameter; hypothallus confluent, silvery white.

Habitat—Decaying angiospermic wood.

Specimens examined—Delhi, Old Delhi Ridge, September 1, 1973, TNL/555.

Notes—The intact fruiting bodies in this population which was collected from a fully drenched angiospermic stump, were apparently like *Steminitis*; the *Arcyria* like nature became evident only after dehiscence. The population differs from the type in having slightly smaller and almost smooth spores.

Arcyria gulielmae Nann.–Brem.

[*Proc. K. ned. Akad. Wet.*, C, **74**, 352–365, 1971. (Figs. 1. f–h)]

Arcyria carnea (G. Lister) G. Lister (*J. Bot.*, **59**, 92, 1921)

Fructifications sporangiate, stalked, up to 3.5 mm in length after dehiscence. Sporangia scattered or loosely clustered, short cylindrical, reddish-brown, 1–1.3 mm long (up to 2 mm after dehiscence); peridium fugaceous with a distinct calyculus; calyculus darker, shining, rugose externally, marked with papillae and broken reticulations on the inner side, irregular at margin; capillitium composed of pale reddish brown threads which branch and anastomose to form a close meshed net with very few free ends, the threads smooth, thick walled, almost moniliform as they originate, marked with close set rings and half cogs higher up which appear blunt, notched or slightly pointed in profile, the threads 3–3.5 μ in diameter, their free ends clavate, densely spiny and broader; spore-mass reddish brown, almost hyaline in transmitted light, mostly globose, marked with 5–7 scattered spines, 6–8 μ in diameter. Stipe mostly 1 mm long, dark brown to almost black, lighter towards apex, filled with spore-like, smooth and large cells which measure 9.3–15.5 μ in diameter; hypothallus white, membranous, rotate.

Habitat—Decaying wood of gymnosperms and angiosperms.

Specimens examined—H.P., Dalhousie, Kalatope, October 7, 1971; TNL/216; H.P., Hamirpur, Haretta, July 1972, TNL/277, 287; Delhi, Old Delhi Ridge, September 1, 1972, TNL/308; U.P., Nainital, Oct. 1972, TNL/377; Delhi, Old Delhi Ridge, Aug. 16, 1971, TNL/113; H. P., Simla, Narkanda, July 6, 1973, TNL/556, 557; H.P., Simla, Glen, July 5, 1973, TNL/569.

Notes—the present collections differ from the type in having slightly longer stipes.

A. gulielmae is closely related to *A. denudata* (L.) Wettst. The two are generally distinguished by the colour and nature of sporangia, length of the stipe and sculpture

of the calyculus and capillitium. The fructifications in the former are scattered or loosely clustered, short cylindrical and flesh coloured, rarely exceeding three mm in length even after dehiscence, the stipe is short, mostly 0.2–0.4 mm in length, the calyculus is marked with papillae and broken reticulations and the capillitial threads bear square, notched or hammer-shaped prominences. In *A. denudata* the fructifications are generally crowded, brick red in colour, long cylindrical with tapering upper end and a size range of 1.5–7 mm; its stipe is striated and 0.5–1.5 mm in length. The calyculus is plicate and the capillitial threads bear distinct cogs or half rings.

The colour distinction between these two species is well marked in fresh specimens. No colour difference is, however, found in older and weathered specimens. The basal capillitial threads in these populations are smooth, and thick walled and bear many equidistant bulbous swellings which make them moniliform in appearance.

Arcyria magna Rex

[*Proc. Acad. Phila.*, **45**, 364, 1893. (Fig. 1. i–l)]

Fructifications sporangiate, stipitate, up to 10 mm in length after dehiscence. Sporangia densely clustered in extensive fruitings, cylindrical, rose-pink, fading to brownish red or yellowish brown, erect in the beginning but drooping later on, 8–10 mm long, after dehiscence sporangia separating and falling away in clusters leaving the stalks and calyculii behind; peridium fugaceous; calyculus, almost funnel-shaped, ribbed, marked by polygonal areas which form a complete or incomplete reticulum with angular thickenings, shining, transluscent; capillitium lax, extremely elastic, easily separating off the stipe and calyculus in tangled masses, capillitial threads branched and loosely anastomosed to form a lax large meshed net, with some free ends which are clavate and swollen, threads 3–4.5 μ wide and marked with cogs, half rings and blunt spines; spore-mass pink or ochraceous depending upon the age of the fruiting bodies, hyaline in transmitted light, spores globose, 6–7.5 μ in diameter, with 4–5 scattered spines on the periphery. Stipe 0.5–1 mm long, deep reddish brown, cylindrical below, broadening out gradually towards apex into the calyculus, filled with spore-like cells measuring 15–24 μ. In dehisced fruiting bodies a clear joint separates the stalk and the calyculus; hypothallus concolourous with the stipe, silvery, confluent.

Habitat—Dead gymnospermous wood.

Specimens examined—H.P., Simla, Glen, June 30, 1973, TNL/552, 553.

Notes—These populations differ from the type in the colour of the sporangia. The type has been stated to possess smoky violaceous grey or dull rose fructifications. These specimens when collected, were undehisced, bright rose pink and deep maroon in colour. They gradually faded to reddish brown and ultimately became smoky and hazy. No such colour gradation is, however, mentioned in the literature for this species. It is not unlikely that the colour of the type is based on dehisced fruiting bodies.

These specimens differ from *A. incarnata* in having much longer fruiting bodies which fall away in tangled masses—a characteristic feature of *A. magna*.

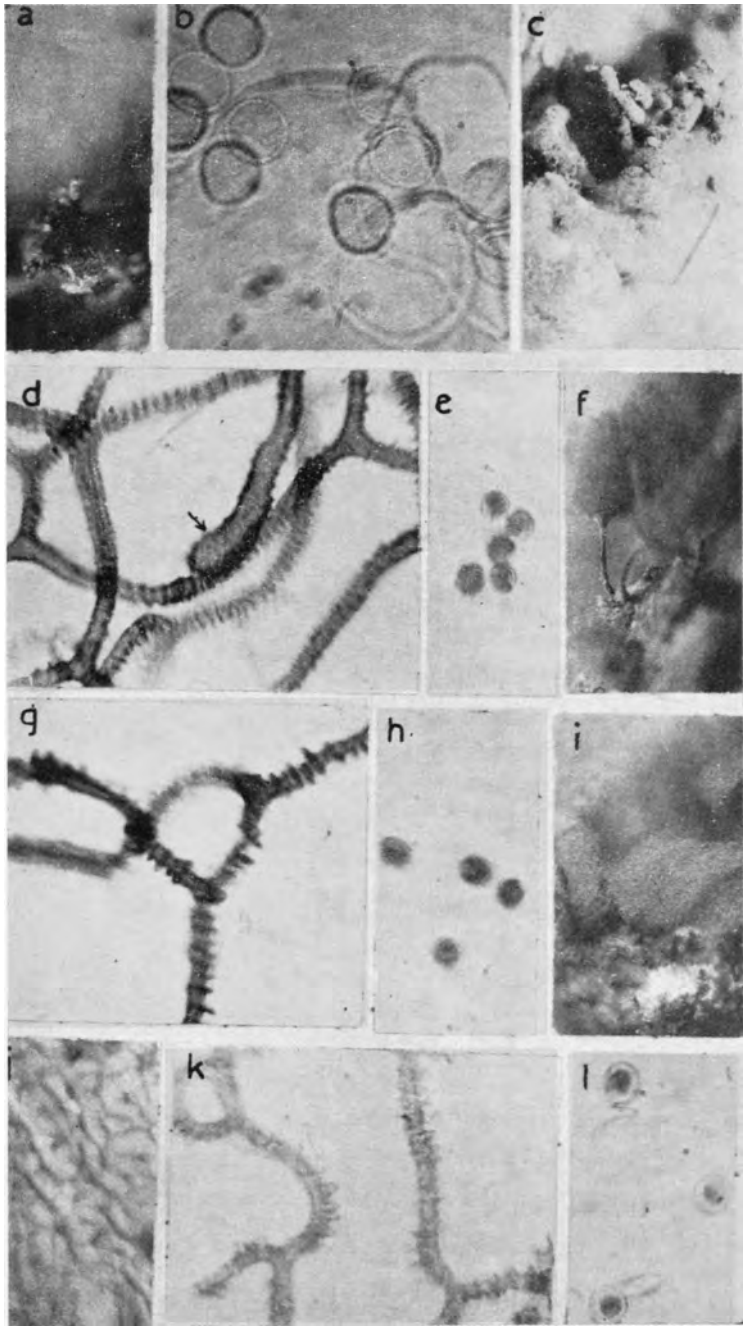

FIG. 1 *a–l*. (*a–b*). *Calomyxa metallica* (Berk.) Nieuwl. : *a*, Single fructification. × 12; *b*, Prominently warted spores and solid capillitial threads. × 750. (*c–e*). *Arcyria affinis* (Rost.) Nann.-Brem. : *c*, Dehisced and undehisced fructifications. × 2.5; *d*, Capillitial net marked with cogs and half rings and showing a single clavate, free end (arrow). × 775; *e*, Spores. × 500. (*f–h*). *Arcyria gulielmae* Nann.-Brem. : *f*, Stalked sporangia. × 6; *g*, Capillitial threads beset with cogs. × 860; *h*, Spores. × 500. (*i–l*). *Arcyria magna* Rex. : *i*, Dehisced fructifications × aprox. 2.5; *j*, Reticulum on the calyculus. × approx. 725; *k*, Capillitial threads. × 725; *l*, Spores. × 800.

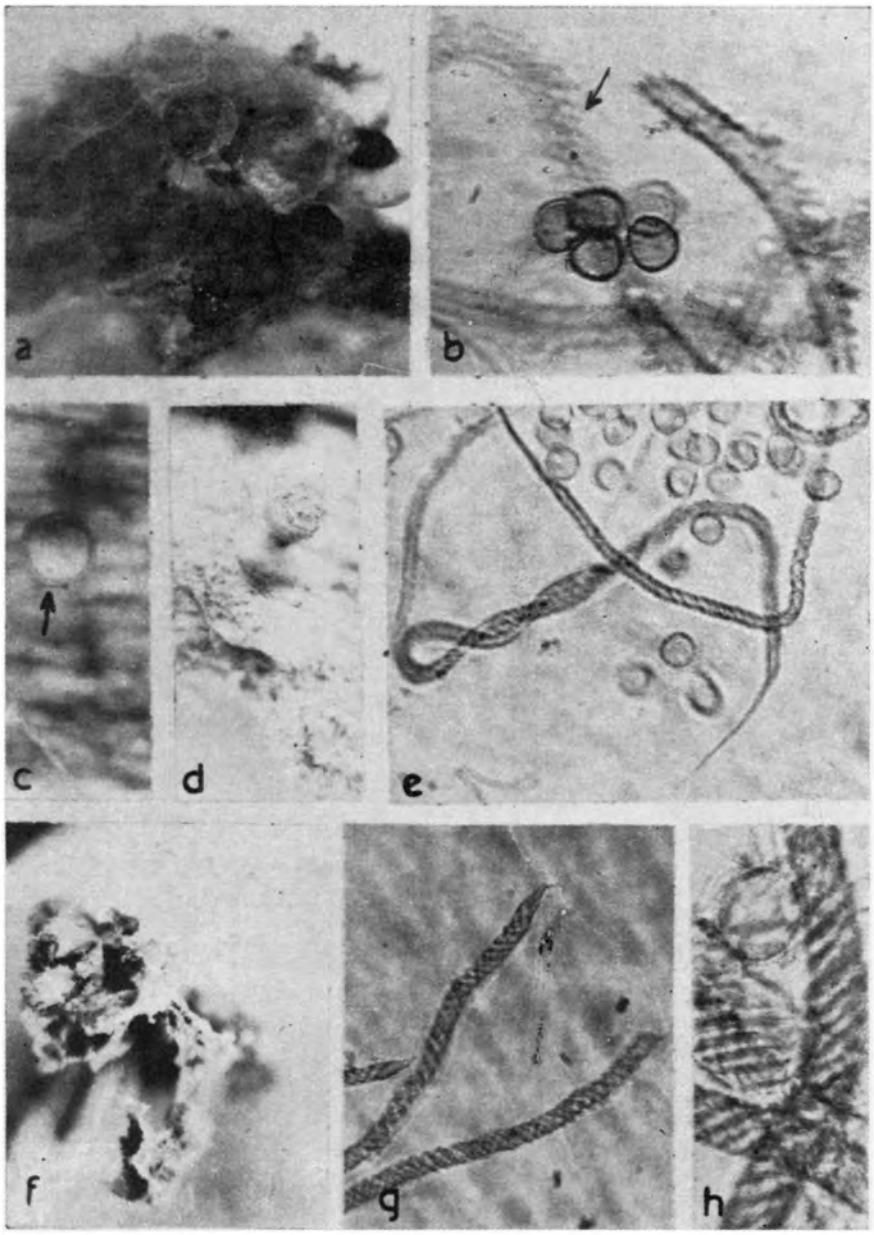

FIG. 2. *a–h* (*a–b*) *Arcyria virescens* G. Lister: *a*, Sporangja crowded and angular by mutual pressure. × 1; *b*, Capillitial thread with an apparent spiral, and spores. × 800. (*c–e*). *Trichia crateriforme* Martin; *c–d*, Operculate (arrow) and dehisced sporangia, × 10; *e*, Twisted capillitial threads with long drawn out ends, and spores. × 430. (*f–h*), *Trichia verrucosa* Berk. : *f*, Clusterd sporangia on fused stipes ×8. *g*, Abruptly narrowed tips of elaters. × 500. *h*, Banded reticulate spores. × 1330.

Arcyria virescens G. Lister

[*J. Bot.*, **59**, 252, 1921. (Fig. 2, a–b)]

Fructifications sporangiate, stipitate, up to 1.6 mm in length. Sporangia densely crowded, becoming angular by mutual pressure and appearing nearly sessile, greenish ochraceous, 0.5–0.8 mm long; peridium fugaceous except for a calyculus at base; calyculus small, funnel-shaped, papillose reticulate within, striated without; capillitium greenish ochraceous in mass, light ochraceous in transmitted light, readily separating from the calyculus, when intact standing like a column, threads branched and anastomosed, marked with closely spaced transverse ridges arranged in an open spiral, remaining surface reticulate, subsequent ridges produce an impression of 2–3 spirals, threads 4–6 μ in diameter, free ends common, clavate, swollen and blunt, with more prominent reticulations; spore-mass greenish-yellow, subhyaline in transmitted light, globose or subglobose, 7–9 μ in diameter, marked with 3–4 minute warts. Stipe dark brown, slender, dull or shining, broadening above into the calyculus, filled with spore-like cells which are 10–14 μ in diameter; hypothallus concolourous with the stipe, confluent.

Habitat—Dead wood.

Specimens examined—U.P., Nainital, Cheena Peak, Nov. 1971, TNL/125.

Notes—The fruiting bodies in this collection are dehisced and it is difficult to ascertain their shape.

The stalk in *A. virescens* has few or no stalk cells (Martin and Alexopoulos 1969). In the present collection of *A. virescens* the stalk cells are very compactly arranged, probably in 2–3 superimposed layers which make the stipe opaque and which when pressed with force separate out in groups.

The calyculus in this population is papillate on the inner side, and the papillae form a complete or incomplete reticulum with thickened angles. The capillitium appears differently in different focii: it may be marked by smooth or sharp-edged spirals which appear interconnected and scalariform. The capillitial net has frequent free ends. They are clavate or truncate and mostly more prominently marked than the remaining threads.

Trichia crateriforme Martin

[*Mycologia*, **55**, 131, 1963. (Fig. 2. c–e)]

Fructifications sporangiate, stipitate, up to 1.3 mm in length. Sporangia scattered, subglobose, obovate or pyriform, up to 1 mm in length and 0.8 mm in diameter, brownish yellow or olivaceous yellow; peridium single thin, membranous, granular, sharply divided between a basal cup and an operculum, the cup shining, operculum dull; dehiscence operculate, the operculum separates from the cup exposing the spore mass and capillitium; capillitium olivaceous yellow, yellow in transmitted light, capillitial threads mostly simple and uniformly 5–7.5 μ in diameter in the middle, tapering and narrower at the tips, marked by 4–5 even or irregular spiral bands, broken spirals spine-like, the tips long, tapering, sometimes tortuous, coiled and bifurcate, elaters mostly bent in the middle and the two halves spirally twisted about each other; spore-mass yellow, paler in transmitted light, globose or subglobose, prominently warted, 10–11.5 μ in diameter. Stipe usually short 0.3–0.4 mm in length, orange-brown, rugose; hypothallus inconspicuous.

Habitat—Decaying gymnospermous wood.

Specimens examined—H.P., Dalhousie, Kalatope, October 7, 1972, TNL/212a and 227.

Notes—These populations differ from the type in having lighter fruiting bodies, narrower capillitial threads and more prominently warted spores.

The capillitial threads in population 212a are tortuous and irregular at the apices, similar to the illustration of *T. contorta* (Ditmar) Rost. as given by Martin and Alexopoulos (1969), but this population is different from *T. contorta* in most of the other features.

Trichia verrucosa Berk.

[in Hook. F.Fl. Tasm., **2**, 269, 1859 (Fig. 2. f–h)]

Fructifications sporangiate, stipitate, up to 2.5 (–3) mm in length. Sporangia clustered on stipes, each sporangium obovoid or pyriform, brownish yellow, 0.9–1.2 mm in length; peridium single, membranous, mostly thickened by granular deposits, translucent, papillate, dehiscence irregular, peridium mostly persistent as a deep cup at base; capillitium yellow in mass, golden or bright yellow in transmitted light, capillitial threads long, smooth, unbranched, cylindrical, up to 6 μ wide in the middle, marked by 3–5 spiral bands which are interconnected by longitudinal striae, terminal ends short, pointed and tapering, mostly .0–11 μ in length; spore-mass yellow, golden yellow in transmitted light, globose, 12–14 μ in diameter including the border, 9.5–12 μ without border, coarsely banded reticulate, bands narrow, minutely pitted, mostly 1 μ high. Stipe weak, long, flattened or procumbent, reddish brown, rugose longitudinally, up to 2 mm in length; hypothallus membranous, confluent, reddish brown.

Habitat—Decaying gymnospermous wood.

Specimens examined—H.P., Simla, Narkanda, July 12, 1974, TNL/600.

Notes—This collection of *T. verrucosa* is comprised only of two sporangial groups. The banded reticulate spores with pitted bands remind those of *T. favoginea,* which however, is a sessile form with spiny elaters and smooth peridium.

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References

Martin, G. W., and C. J. Alexopoulos. (1969). The Myxomycetes. University of Iowa Press, Iowa city.

Nannenga, Bremekamp, N. E. (1968). Notes on Myxomycetes. XIV. Remarks on the delimitation of some *Arcyria* species. *Proc. K. ned. Akad. Wet., C.,* **71**, 31–40.