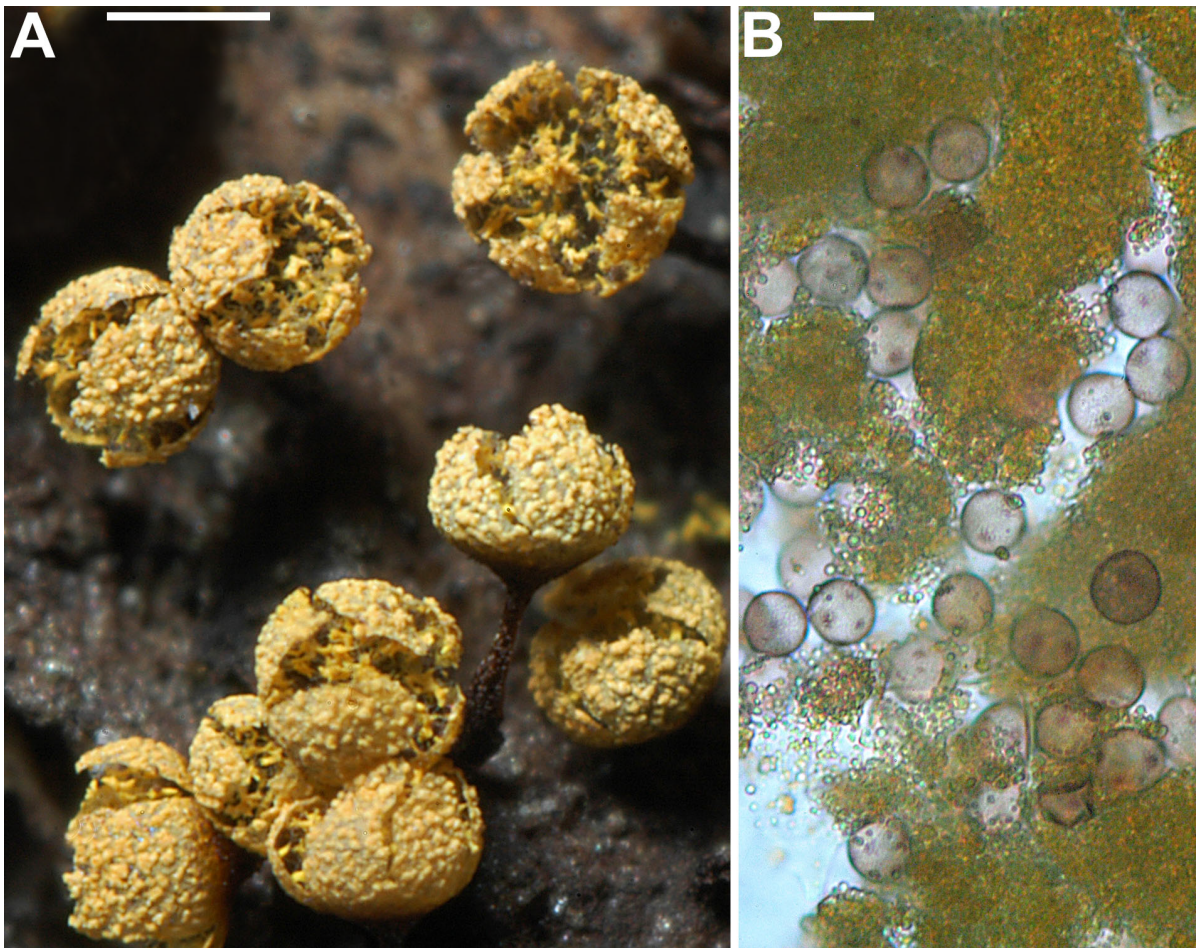

A. Sporocarps, habit (bar = 1 mm). **B**. Spores (bar = 10 µm). [Photographs: A. Michaud]

Physarum auriscalpium Cooke, *Annals of the Lyceum of Natural History of New York* **11**: 384 (1877). [*IndexFungorum* 434176; *Physaraceae*, *Physarales*]

Physarum rubiginosum var. *auriscalpium* (Cooke) Sacc. & D. Sacc., in P.A. SACCARDO, *Sylloge Fungorum* **18**: 210 (1906). [*IndexFungorum* 147709]

Physarum limonium Nann.-Bremek., *Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen* Series C, Biological and Medical Sciences **69**(3): 357 (1966). [*IndexFungorum* 336968]

Vernacular names. Dutch: *oranjegeel kalkkopje*.

Diagnostic features. Most similar to *Physarum oblatum* T. Macbr., but differing in stalk lengths and in the size and shape of the sporangia.

On natural substratum. *Plasmodium* orange or greenish. *Hypothallus* inconspicuous. *Sporocarps* orange, tawny or green to the unaided eye, primarily as short plasmodiocarps, sometimes intergrading into sessile or rarely short-stipitate sporangia. *Plasmodiocarps* curved or straight, sometimes branching or annulate,

0·5–1·2 mm diam. *Sporangia* gregarious, circular to irregular, pulvinate or subglobose, or clustered and angled by mutual pressure, mottled with brown, red, yellow, or white, with a dark red or brown inner base. *Stalk* when present, dark, furrowed. *Peridium* smooth, membranous, firmer and persistent below, yellowish or smoky, dotted or netted with glossy, often anastomosed lime scales, especially above, often without lime at the base; if speckled on the outside, then with large, separated, clustered or reddish, yellowish, or white lime-granules. *Capillitium* dense, composed of many large, angular, branching or netted lime-knots, orange, yellow, pale yellow, or nearly white, rarely tinged with red, connected by short or long colourless tubules, or the tubules lacking and the nodes free. *Columella* absent. *Spores* black *en masse*, globose, pale to rather dark brown, violet-brown, slightly roughened to minutely warted, spinulose or ornamented with small groups of spines, (8–)9–12(–13) µm diam.; ornamentation consisting of tight rods in a semi-regular arrangement when viewed with the SEM.

ASSOCIATED ORGANISMS & SUBSTRATA: **Fungi**. *Ceratocystis fimbriata* Ellis & Halst. [as *Sphaeronema fimbriatum* (Ellis & Halst.) Sacc. (mycelium). **Plantae**. *Acer hyrcanum* subsp. *stevenii* (Pojark.) E. Murray [as *A. stevenii* Pojark.] (bark), *A. pseudoplatanus* L. (bark); *Alnus incana* subsp. *tenuifolia* (Nutt.) Breitung [as *A. tenuifolia* Nutt.] (twig); *Bryophyta* sp. [as 'moss']; *Carya glabra* (Mill.) Sweet (bark), *Carya* sp.; *Cercis canadensis* L. (bark); *Cocos nucifera* L.; *Conocarpus erectus* L. (trunk); *Cupressus* sp. (bark); *Cylindropuntia fulgida* (Engelm.) F.M. Knuth [as 'jumping cholla', also as *Opuntia fulgida* Engelm.]; *Gardenia* sp. (leaf); *Hevea* sp. (wood); *Fraxinus excelsior* L. (bark), *Fraxinus* sp. (bark); *Juniperus* sp. (bark); *Malus domestica* Borkh. (bark); *Mangifera indica* L. (bark); *Musa* sp. (sheath); *Palmae* indet. (petiole); *Passiflora* sp. (leaf); *Picea abies* (L.) H. Karst. (bark); *Pinus nigra* J.F. Arnold (log), *P. ponderosa* Douglas ex C. Lawson (bark), *Pinus* sp. (bark, leaf); *Plantae* indet. (bark, branch, log, wood); *Populus tremula* L. (bark), *P. trichocarpa* Torr. & A. Gray ex Hook., *Populus* sp. [as 'cottonwood'] (bark); *Pritchardia* sp. (stipule); *Purshia mexicana* (D. Don) Henr. [as *Cowania mexicana* D. Don]; *Quercus agrifolia* Née (bark), *Q. alba* L. (bark), *Q. pubescens* Willd. (bark), *Quercus* sp. (bark, leaf); *Rhizophora mangle* L. (twig); *Rhododendron* sp. (bark); *Rhus chinensis* Mill.; *Salix* sp. [as 'willow'] (twig); *Terminalia catappa* L.; *Tilia cordata* Mill. × *platyphyllos* Scop. (bark); *Ulmus* sp. (bark); *Vitis aestivalis* Michx. **Associated organism of type specimen**. *Plantae* indet. [as 'rotten wood'].

INTERACTIONS & HABITATS: Most information about this species is based on sporocarps and spores (the dispersal phase), and observed associations with other organisms usually only indicate the physical substratum on which sporocarps form. Other observations are rare, particularly of trophic phases (myxamoebae and swarm cells [individual haploid amoeba-like cells], and plasmodia [multi-nucleate, diploid, and often extensive cytoplasm]), and dormant phases (microcysts and sclerotia). As a result, very little is known about nutrition and interactions beyond broad statements that myxomycetes feed on living bacteria and fungi, and on non-living organic material (MARTIN & ALEXOPOULOS, 1969). In a study of myxomycete distribution and habitats in temperate forests of southwestern Virginia, STEPHENSON (1989) found that occurrence of this and other bark-inhabiting species depended on differences in substratum acidity and texture. In Costa Rica, a study of the effect of altitude on myxomycete diversity, including the present species, found no correlation (ROJAS *ET AL.*, 2016). This species is found predominantly on bark of living trees, but has also been recorded on dead and decayed bark, dead tree trunks, aerial and ground litter of woody plants including fallen leaves and rotten wood, palm petioles still attached to trunks, moss, and occasionally herbaceous litter. Most records are from woodland, including temperate and tropical mixed natural or semi-natural forest, mixed plantations and scrub. This species has been recorded from the following habitats: amenity & protected areas (including nature reserves and parkland); farmland (including orchards); deserts; mangroves. Several fungi have been observed growing on the same substratum, and there are reports from Malaysia that the present species may be parasitic on fungal mycelium (HOWARD & CURRIE, 1932). Beyond what is known generally about the nutrition of *Physarum*, there is no information about any specific associations with animals or micro-organisms.

GEOGRAPHICAL DISTRIBUTION: AFRICA: Morocco, South Africa, Tanzania. CENTRAL AMERICA: Belize, Costa Rica, Panama. NORTH AMERICA: Canada (Alberta, British Columbia, Manitoba, Ontario, Quebec), Mexico, USA (Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Illinois, Iowa,

Kansas, Kentucky, Louisiana, Maine, Michigan, Missouri, Montana, Nevada, New Hampshire, New Jersey, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Texas, Utah, Virginia, West Virginia). SOUTH AMERICA: Brazil (Bahia, Pernambuco, Rio de Janeiro, São Paulo), Ecuador, Venezuela. ASIA: China (Hunan, Jilin), India (Himachal Pradesh, West Bengal), Japan, Malaysia, Russia (Krasnoyarsk krai, Novosibirsk oblast, Sverdlovsk oblast), Taiwan, Thailand, Turkey. ATLANTIC OCEAN: Spain (Canary Islands). AUSTRALASIA: Australia (Victoria), New Zealand. CARIBBEAN: American Virgin Islands, Antigua and Barbuda, Dominica, Guadeloupe, Puerto Rico, St Lucia. EUROPE: Austria, Belarus, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Russia (Leningrad oblast, Moscow oblast, Republic of Karelia, Tver oblast), Spain, Ukraine, UK. INDIAN OCEAN: Seychelles. PACIFIC OCEAN: USA (Hawaii).

Probably cosmopolitan and presumably native throughout all or most of its known range, but status in New Zealand reported as unclear [*Landcare*, accessed 3 August 2017]. Records up to 2695 m above sea level in USA, 1300 m above sea level in Turkey, and 1050 m in Spain.

ECONOMIC IMPACTS: No evaluation has been made of any possible positive economic impact of this organism (e.g. as a recycler, as a source of useful products, as a provider of checks and balances within its ecosystem, etc.). No reports of negative economic impacts have been found.

INFRASPECIFIC VARIATION: No subspecific taxa have been described [*SpeciesFungorum*, accessed 21 August 2017].

DISPERSAL & TRANSMISSION: Primarily by airborne spores, particularly for longer distances; some local dispersal may also occur by movement of myxamoebae and plasmodia.

CONSERVATION STATUS: **Previous evaluations**. None. **Information base**. Over 600 records (specimens, databases and bibliographic sources combined, excluding duplicates) from at least 1877 to January 2013, with observations in every month of the year. **Estimated extent of occurrence** [calculated using *http://geocat.kew.org*]. Over 81·7 million km^2 (Africa: 15·5 million km^2; Asia: 29·2 million km^2; Atlantic, Indian and Pacific Oceans: insufficient data; Australasia: insufficient data; Caribbean, Central and North America: 20·7 million km^2; Europe: 7·7 million km^2; South America: 8·6 million km^2). **Estimated area of occupancy** [calculated using *http://geocat.kew.org*]. Well over 700 km^2. The method for estimating area of occupancy has produced an artificially low figure. The species is likely to be under-recorded, despite the admirable and well-organized enthusiasm of often amateur myxomycete experts, because compared with recording of flowering plants and vertebrates, so few people have the skills to search for and identify it. Many of the plants with which it is associated are common and widespread species. **Threats**. *Climate change*. May be a threat. *Habitat destruction*. Loss of Malaysian tropical rainforest of this and other myxomycetes as a result of rubber plantations was noted as far back as the early 20th century by SANDERSON (1922). *Pollution*. A study (which included the present species) of the effects of acid deposition on tree bark myxomycetes in Missouri and Tennessee found that diversity declined with higher elevation and higher levels of aerial pollutants (SCARBOROUGH *ET AL.*, 2009). Insufficient information to enable other threats to be identified. **Population trend**. In general, not known. Rare in southwestern Virginia and Himachal Pradesh (STEPHENSON *ET AL.*, 1993), but reported by ERGÜL *ET AL.* (2005) as one of the most common myxomycetes of northwestern Turkey. ERGÜL *ET AL.* (2005) and YAĞIZ & AFYON (2007) report many records of this species from Turkey, but the on-line pages they cite are no longer available. Of datable records, *c.* 25% are pre-1961, 65% post-1960 but pre-2001, and 10% post-2000. **Evaluation**. Using IUCN criteria (IUCN SPECIES SURVIVAL COMMISSION. *2006 IUCN Red List of Threatened Species* [*www.iucnredlist.org*]. Downloaded on 15 May 2006), the species is assessed globally as Least Concern. ***In situ* conservation actions**. None explicitly directed at this species, but many of the sites from which it has been recorded are protected, for example as nature reserves. ***Ex situ* conservation actions**. *Physarum* species, including the present species (CLARK, 1995) grow readily in culture and, using simple techniques, can be induced to sporulate. There are, however, no living strains of this species listed by the Straininfo website [*www.straininfo.net*, accessed 4 August 2017]. No nucleotide

sequences were found in a search of the NCBI GenBank database [*www.ncbi.nlm.nih.gov*, accessed 4 August 2017].

NOTES: Scanning electron micrographs of spores of this species were provided by MORENO *ET AL.* (2001). It may be conspecific with *P. decipiens* M.A. Curtis (LADO, 1994. LIZÁRRAGA *ET AL.*, 2003). For further help with identification, the excellent keys provided by POULAIN *ET AL.* (2011) should be consulted.

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