Plant Archives Vol. 21, No. 2, 2021 pp. 614-618 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2021.v21.no2.093

PHYSALIS PRUINOSA L., A HIGHLY INVASIVE SPECIES: NEW DISTRIBUTIONAL RECORDS FROM UTTAR PRADESH, INDIA

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(Date of Receiving : 02-05-2021; Date of Acceptance : 06-08-2021)

ABSTRACT

A highly invasive plant *Physalis pruinosa* L. is recorded from Mirzapur, Pratapgarh and Varanasi districts of Uttar Pradesh, India. Previously, this species is only known from Chitrakoot and Lucknow district of Uttar Pradesh. Within five years (2014–2019), this species is reported as a new record for six states of India viz. Madhya Pradesh, Maharashtra, Odisha, Tamilnadu, Uttar Pradesh and Uttarakhand, confirming its alarming rate of invasiveness. This plant species is growing with other highly invasive species like *Amaranthus spinosus* L., *Senna obtusifolia* (L.) H. S. Irwin & Barneby, *Cleome viscosa* L., *Corchorus olitorius* L., *Croton bonplandianus* Baill., *Parthenium hysterophorus* L., *Physalis angulata* L., *Sida acuta* Burm. f., *Xanthium strumarium* L. etc.
Keywords: *Physalis pruinosa,* Solanaceae, report, invasive, Uttar Pradesh, India

INTRODUCTION

The family Solanaceae Juss. belongs to the order Solanales in the asterid group of eudicots (APG, 2016). The family has about 2,700 species worldwide under 98 genera (Yadav *et al*., 2016). The genus *Physalis* L. of this family comprises about 100 species worldwide (Beest *et al.,* 1999; POWO, 2019). In India, this genus has about 6 species— *P. alkekengi* L., *P. angulata* L. (= *P. minima* L.), *P. ixocarpa* Brot. ex Hornem., *P. longifolia* Nutt. (= *P. virginiana* Mill. var. *sonorae* Torrey), *P. peruviana* L. and *P. pruinosa* L. (= *P. maxima* L.) (Deb, 1979; Singh & Datt, 2014). Recently, Kottaimuthu *et al*. (2019) reported *P. grisea* (Waterf.) M.Martínez as a new record from India. *P. alkekengi* L. is now synonym of *Alkekengi officinarum* Moench (POWO, 2019) and the collections of *P. longifolia* Nutt. (*P. virginiana* Mill. var. *sonorae* Torrey) from India is also doubtful (Raju *et al*., 2007).

The species *P. pruinosa* L. was discovered as a new record for India (Singh & Pandey, 2002). After discovery, this species was reported from Gujarat and soon recognized as invasive alien species (Meena, 2005; Reddy *et al.,* 2008). It was found that this species made its way in India in Jodhpur, Rajasthan (Singh & Pandey, 2002). Within a short span of time this species was reported from various states of India, indicating its alarming rate of invasiveness: Maharashtra (Somkumar *et al*., 2014), Uttarakhand & U.P. (Singh & Datt, 2014), M.P. & Tamilnadu (Meena, 2015; Kottaimuthu & Kalidass, 2015), Odisha (Singh *et al*., 2017).

As far as Uttar Pradesh (U.P.) is concerned, this species was reported by Singh and Datt in 2014 from Lucknow district. Sikarwar *et al*. (2019) also reported this plant species from Chitrakoot district of U.P.

During our field survey in September 2019, we encountered *Physalis pruinosa* L. at Pratapgarh Railway Station, Pratapgarh, Uttar Pradesh. Further this species was also recorded in Mirzapur and Varanasi districts of Uttar Pradesh. In this manuscript, detailed description, field photographs and microscopic photographs of *P. pruinosa* are provided.

MATERIALS AND METHODS

The specimens were collected and photographed in the field. In lab fresh specimens were pressed and some twigs were used for description, dissection and photography of minute parts using Stereo Zoom Microscope (Magnus: MSZ-TR) with attached camera (CatCam300EF). Herbarium was prepared using standard methods (Jain & Rao, 1978). All the herbarium sheets were kept in the Department of Botany, Banaras Hindu University for future reference.

Pollen grains of *Physalis pruinosa* were taken in a drop of water on a coverslip and air dried. It was fixed using 4% (w/v) glutaraldehyde overnight, rinsed in distilled water and dehydrated using graded series of ethanol followed by air drying. Air dried sample was coated with 30 Å thick gold palladium coating in quarum Sc 7620 sputter coater (Carl Zeiss, Germany) for 10 min. Coated sample was viewed at 10 kV by scanning electron microscopy (Evo18 Research ZEISS) at Department of Geology, Banaras Hindu University, India.

OBSERVATIONS

Physalis pruinosa L., Sp. Pl. 184. 1753

= *Physalis maxima* Mill.

Description: Annual, erect herb; to 2 feet long. Stem cylindrical with long glandular hairs. Leaves simple,

alternate, sparsely hairy all over above, hairy mainly at nerves below, 15–18 × 10–12 cm, broadly ovate, apex acute to shortly acuminate, base cordate, margin sinuate dentate, often with unequal sides. Petiole 8–12 cm long, hairy, slightly grooved above. Flowers solitary, axillary. Pedicel ca. 2 cm long, hairy. Calyx campanulate, hairy, ca. 08 cm long, lobes 5, subulate, longer than tube. Corolla yellowish white, campanulate, ca. 7 mm long, 1 cm across, similar to leaf shape in outline (anterio-posteriorly), marked with 5 green spots at the throat. Stamens 5, yellow, filaments ca. 3 mm long, anther ca. 2 mm long, oblong, basifixed. Ovary ca. 1.8 × 1.4 mm, ovules many, Style including stigmatic region ca. 4 mm long, gradually thick towards top. Fruiting calyx large, 3–4 cm, inflated, strongly nerved. Fruit a berry. Seeds many.

The pollen unit is a monad unit. Pollen type: 3-zonocolporate. Polar axis ca. 20µm. Equatorial axis ca. 18µm. P/E ratio: 1.11µm.Pollen shape: spheroidal.

Phenology: Flowering & Fruiting in August to December.

Habitat: Waste places, generally near roadsides and railway tracks.

Distribution: Native of Mexico and Central America; Introduced into tropical Asia. India: Andhra Pradesh, Gujarat, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttarakhand and Uttar Pradesh.

Specimen Examined: Uttar Pradesh, Pratapgarh railway station, 137 m a.s.l., 25° 54' 43.8984" N, 82° 0' 10.314" E, 03 Sep 2019, *Singh 0150*; Uttar Pradesh, Varanasi, Sear Goverdhan, 137 m a.s.l., 25° 15' 11.4768" N, 82° 59' 50.0712" E, 15 Sep 2019, *Singh 0151*; Uttar Pradesh, Mirzapur, Near Chunar Fort, 137 m a.s.l., 25° 7' 42.492" N, 82° 52' 45.0408" E, 26 Sep 2019, *Singh 0152*, *Singh 0153*, *Singh 0154*; E00641552, E00641553, E00684442, E00615339 (http://data.rbge.org.uk/herb/); K001071979 (http://specimens.kew.org/herbarium/).

Associated Plants: *Amaranthus spinosus* L., *Senna obtusifolia* (L.) H.S. Irwin & Barneby, *Cleome viscosa* L., *Corchorus olitorius* L., *Croton bonplandianus* Baill., *Parthenium hysterophorus* L., *Physalis angulata* L., *Sida acuta* Burm. f., *Xanthium strumarium* L.

DISCUSSION

Invasive alien species are the second largest cause of biodiversity loss in the world and impose high costs to agriculture, forestry, and aquatic ecosystems (Genovesi *et al*., 2015; Singh, 2005). Introduced species are a greater threat to native biodiversity than pollution, harvest, and disease combined (Reddy *et al*., 2008). Therefore, documentation of invasive species is very important as soon as possible to protect our natural wildlife. *Physalis pruinosa* has become the serious threat to our biodiversity due to fastest invasion. Moreover, the associated plants growing with this species e.g. *Amaranthus spinosus*, *Senna obtusifolia, Cleome viscosa, Corchorus olitorius*, *Croton bonplandianus, Parthenium hysterophorus, Physalis angulata, Sida acuta*, and *Xanthium strumarium* are also known to be highly invasive from several works (Khanna, 2009; Reddy *et al*., 1999; Reddy *et al*., 2008; Singh *et al*., 2010). This species in combination with others highly invasive species will be a challenge for native plants. Control measures should be taken immediately to control this species in association with others. Although there are several works have been done on this genus, a detailed revision is needed to reveal the distribution and correct nomenclature for all the species residing in India.

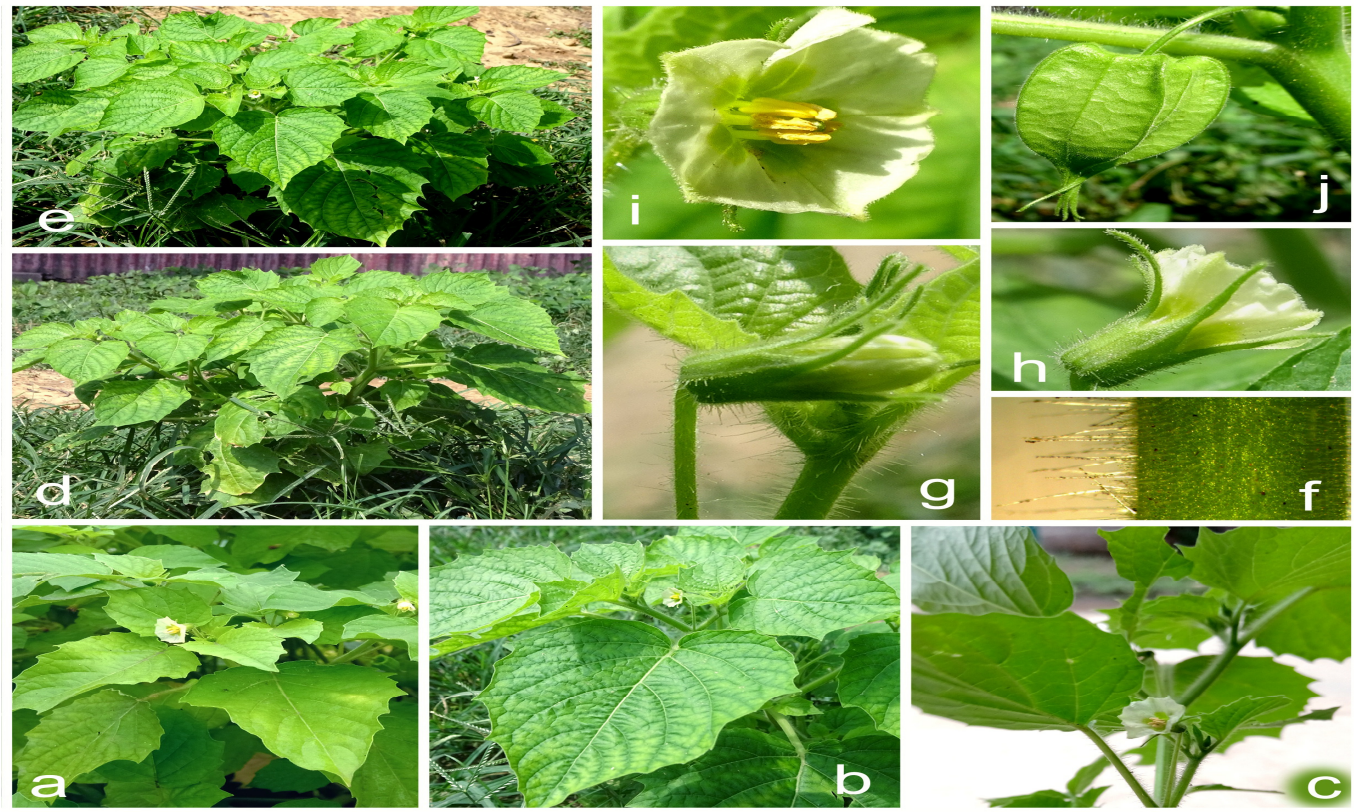

Figure 1. *Physalis pruinosa*. a. Photographed in Mirzapur district, b. Photographed in Pratapgarh district, c. Photographed in Varanasi district, d–e. Habit (side view & top view, respectively), f. Stem hairs, g. Flower bud, h. Calyx, i. Flower, j. Fruit

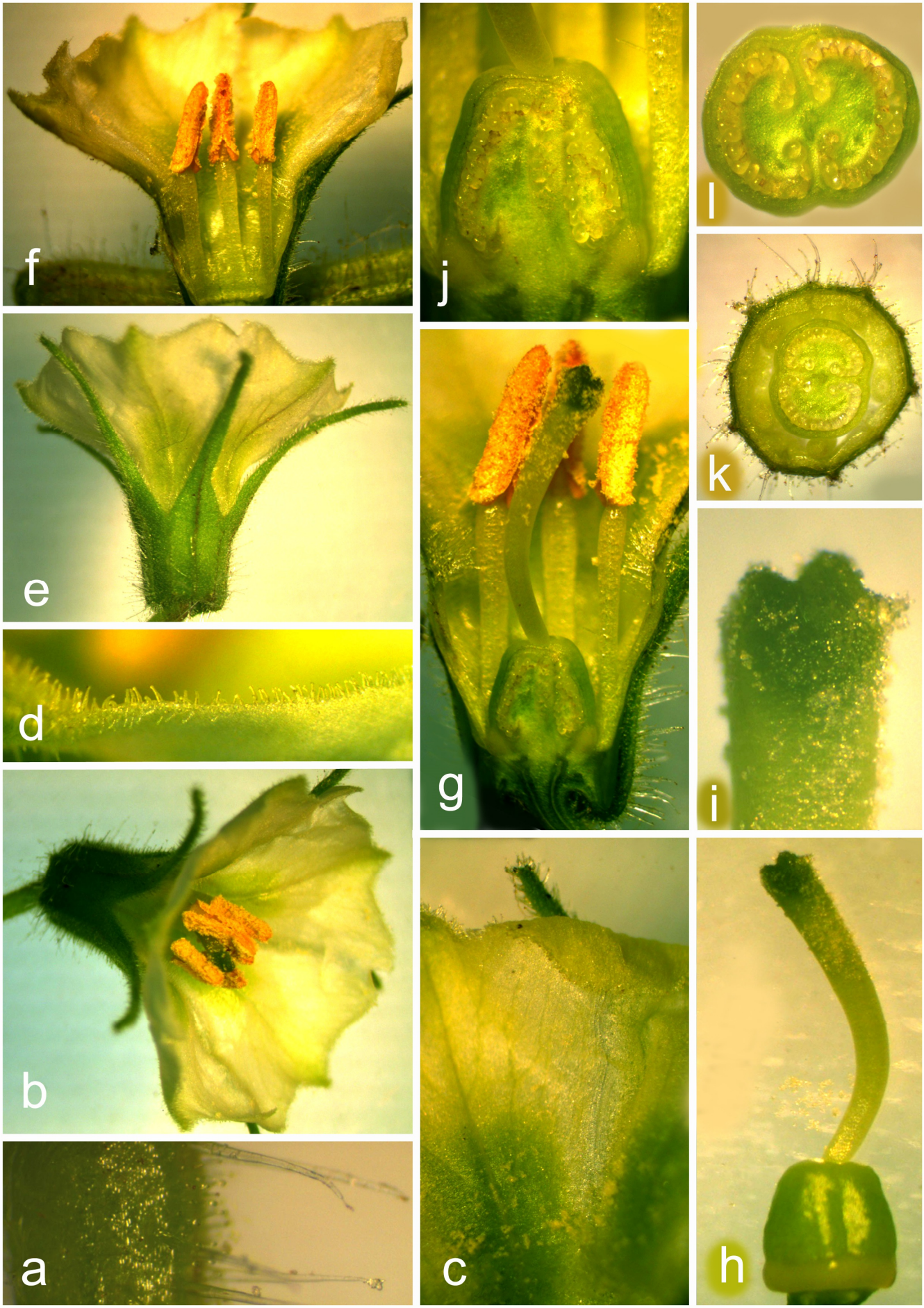

Figure 2. *Physalis pruinosa*. a. Pedicel hairs, b. Flower, c. Green dots on corolla, d. Hooked hairs along corolla margin, e. Calyx, f. Stamens, g. Flower L.S., h. Gynoecium, i. Stigma, j. Ovary L.S., k–l. Ovary T.S.

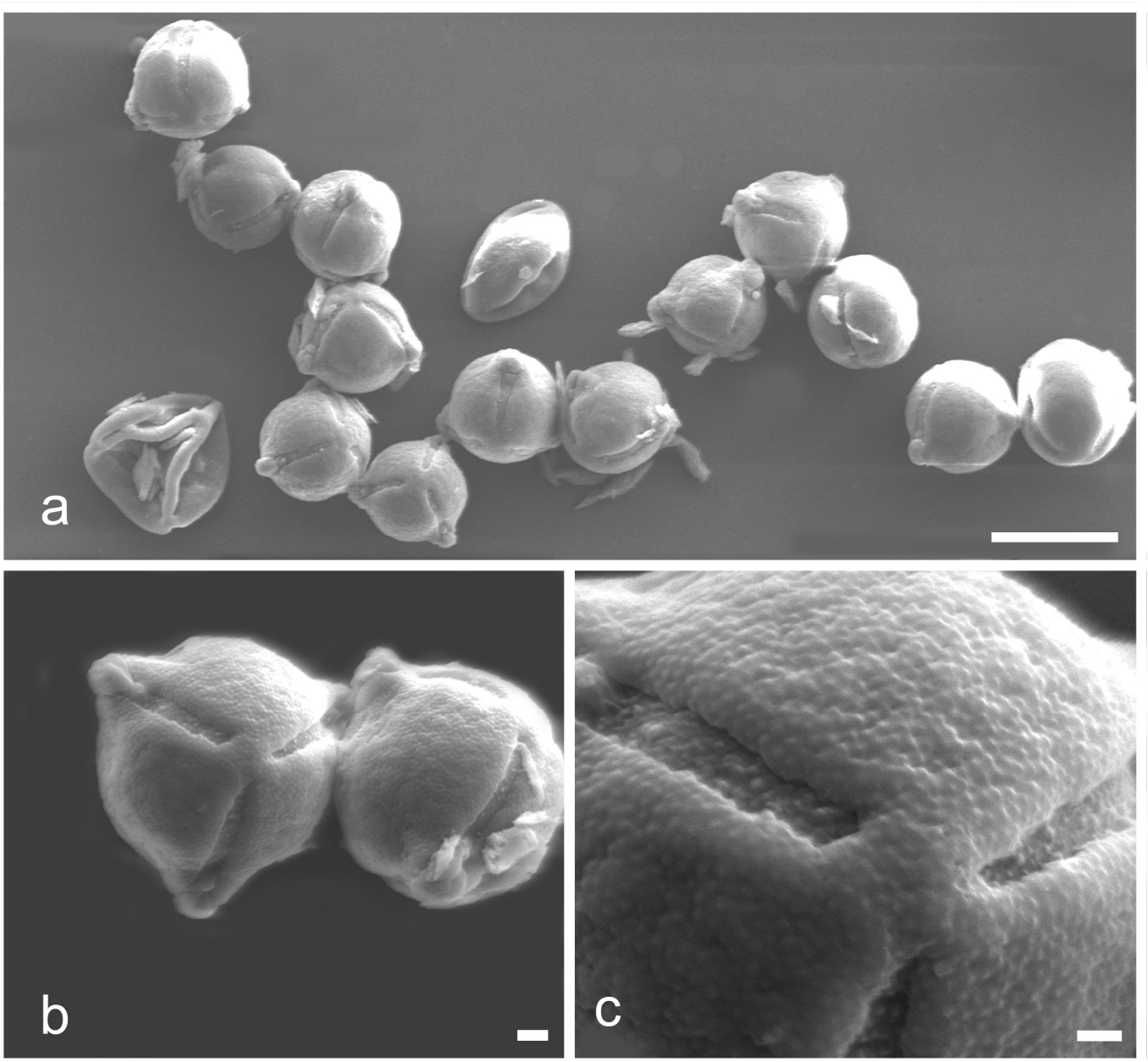

Figure 3. Scanning electron micrograph showing the structure and exine sculpture of *Physalis pruinosa* pollen grains: a. Pollen grains, b. polar view, c. exine structure. Scale bars a = 20 µm, b = 2 µm, c = 1 µm

Acknowledgements

Authors are thankful to the Head of the Department of Botany, Institute of Science, Banaras Hindu University, Varanasi for providing laboratory facility and UGC for providing financial assistance to Vinay Kumar Singh.

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