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## First time report of gall formations and plant part deformations in *Acemella oleracea* caused by *Thecaphora spilanthes* in India

**Arunkumar Phurailatpam, Taibanganbi Chanu, Anju Choudhury, Kalkame Ch. Momin, N Surmina Devi, Priyanka Irungbam and T Shantibala**

**Abstract**

*Acemella oleracea* (Akarkara or Tootache plant) (Family: Asteraceae) is a medicinal herbaceous plant that is widely found in the North East Region (NER) of India. It has essential medicinal properties and measured as chief ingredient of the *Adi* tribe's local cuisine. Gall formation of *A. oleracea* is an emerging threat to local medical plant grower. A survey was conducted in East Siang district, Arunachal Pradesh and 62-76% of disease incidence of *A. oleracea* gall formation was recorded. In the initial stage, light green elongated gall formation on stem and floral were observed and later the gall turns brownish and ruptured the stem thereby break off the food supply to the upper part of the infected plants and killing the upper portion of the plant. The infection causes severe losses and reduces plant quality. The microscopic study revealed that the spores are compact spore balls of light to dark brown in colour. With the study of characteristic symptoms and nature of spores, it was confirm that Akarkara gall formation is a smut disease caused by *Thecaphora sp* under the order "Ustilaginales". With the identification report from Herbarium code no. 2022-23/PP/HCIO/03, dated 24.01.2023, IARI, New Delhi Code No, it was verify that the causal organism is *Thecaphora spilanthes* Freire & Vanky causing smut or gall of *A. oleracea*. The present finding represents the first report of *A. oleracea* gall formation or smut caused by *Thecaphora spilanthes* Freire & Vanky in India.

**Keywords:** *Acemella oleracea*, Akarkara, toothache, India, *Thecaphora spilanthes*, gall

**Introduction**

*Acemella oleracea* (Akarkara or Tootache plant) (Family: Asteraceae) is an annual medicinal herbaceous plant that is widely cultivated for horticultural, medicinal, insecticidal, and culinary purposes and application for this purpose is still widespread in tropical and subtropical regions of the world (Sharma *et al.*, 2012; Sabita R *et al.*, 2019) [12, 10]. *A. oleracea* is also documented from different parts of India such as Chhattisgarh, Jharkhand and South India (Arif M *et al.*, 2017) [1]. The plant grows well in swampy areas, well-drained soil with a pH of 6.1 to 6.5. It can be simply propagated through stem cutting, seed and micro-propagation through various explants (Saritha *et al.*, 2002; Haw and Keng, 2003) [13, 6]. However, in North Eastern Region (NER) of India, it is most commonly consumed as local leafy vegetable in addition to used for medicinal purpose. It has essential medicinal properties and measured as chief ingredient of the Arunachal Pradesh *Adi* tribe's local cuisine. *Adi* tribe and other sub-tribes mostly consumed as boiled food item. The leaves and flowers of this plant are used in the preparation of infusions for the treatment of toothache, dyspepsia, malaria, mouth and throat infections (Semwale *et al.*, 2021) [14]. Locally it is used for treatment of toothache and gum infections. It has been reported to have various biological activities like anti-inflammatory, anti-oxidant, immunomodulatory, hepatoprotective, antipyretic, antidiuretic, anticancer, anti-toothache, etc (Sabita *et al.*, 2019) [10]. These activities are attributed to numerous bioactive compounds, such as phytosterols, phenolic compounds and N-alkylamides (Rondanelli *et al.*, 2020) [9]. The plant contains an important bioactive compound 'Spilanthol' responsible for its medicinal properties. It has high industrial demand for its use in pharmaceutical, aesthetic and toothpaste industry. The flower head extract of *A. oleracea* found to be effective against the polyphagous, serious agriculture pest, *Spodoptera litura* (Sabitha and Murty, 2009) [11]. It has also antifungal activities against the different fungal pathogens such as *Aspergillus niger*, *Aspergillus parasiticus*, *Fusarium oxysporum*, and

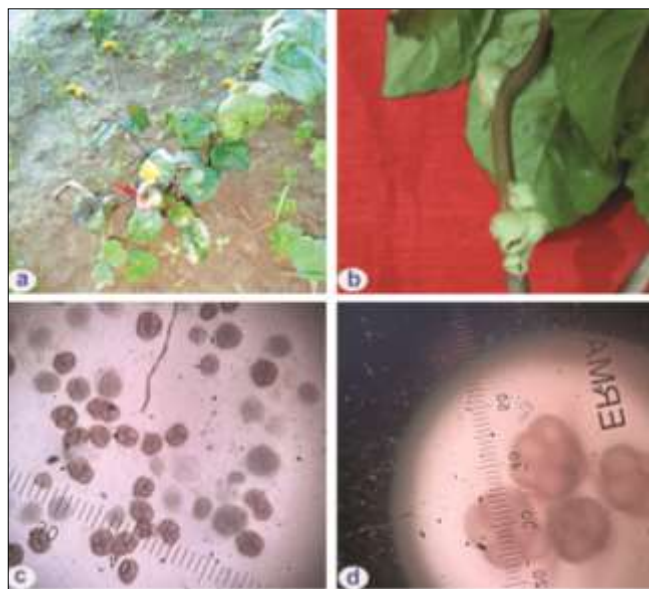
*Fusarium moniliformi* (Sabitha and Murty., 2006) [12]. Despite of its rich source of therapeutic constituents, anti-bacterial and fungicidal properties, and this plant has been faced with biotic stress with characteristic symptom of gall formation on entire aerial parts of the plant in East Siang District, Arunachal Pradesh, India.

### Material Methods

A survey was conducted during 2021-2022 in three blocks of East Siang District, Arunachal Pradesh viz., Mebo (latitude of 28° 9' 55.4364" N and longitude of 95° 25' 22.0296"E), Pasighat (latitude of 28°04'12.00" N and longitude of 95°19'48.00" E) and Ruksin (latitude of 27°50'42.5328" N and longitude of 95°14'50.4420"E). The field survey was carried out to identify the newly emerged gall formation disease by studying their characteristic symptoms and to detect the incidence of *A. oleracea* gall formation on different plant parts. The data were collected on total number of infected plants, total number of plant examined; number and size of gall formation on different parts of the plant. The infected plant samples were collected and brought to the laboratory for further examination. The disease incidence was recorded by using following formula given by Singh and Dube (1978) [16].

$$\text{Disease incidence (\%)} = \frac{\text{Total number of infected plant}}{\text{Total number of plant examined}} \times 100$$

For the further species confirmation and identification the infected plant samples were sent to Herbarium Cryptogamae Indiae Orientalis (HCIO), Indian Agricultural Research Institute (IARI), New Delhi.

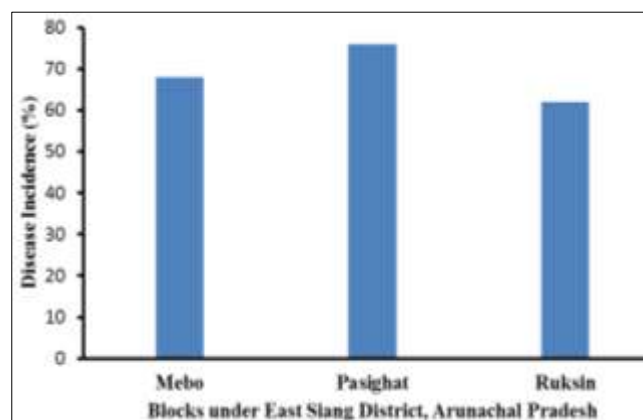


**Plate 1:** (a) Infected plant by *Thecaphora spilanthes* (b) Close up view of gall formation in the stem (c) Spores seen under 10X magnification (d) Clusters of spores under 40X magnification

### Result and Discussion

In the field it was observed that the infected plants show deformations of elongated irregular galls in the stems and leaf veins. Younger galls were light green in colour, protruding with a smooth surface. At the later stage, the gall turns brownish and ruptured the stem thereby break off the

food supply to the upper part of the infected plants and killing the upper portion of the plant. At the first observation, the symptoms shown by the infection had similarities with those of nematode infection. Coutinho *et.al.*, (2006) [2] reported that the gall formation due to *Thecaphora spilanthes* are resemblance to those diseased symptoms shown by certain fungal and bacterial pathogen due to hyperplasia and hypertrophy of the cells of the host. Kruse *et.al* (2018) [7] state that the genus *Thecaphora* produce sori in different parts of plants (flowers, fruits, seeds, stems, leaves or roots) often in galls or pustules. Inside these galls, the spore balls of yellowish-brown to reddish-brown are produced in large numbers. The maximum disease incidence of *A. oleracea* gall formation was recorded in Pasighat with 76% followed by Mebo (68%) and Ruksin (62%) respectively. Isolation was done in potato dextrose agar (PDA) media however; it was unsuccessful (Freire, 1986; Vánky, 1987; Vánky, 1996) [5, 20, 17]. The study of microscopic morphological under 10x and 40x revealed that the spores are compact and composed of 2 to 8 tightly bound spore balls of light to dark brown in colour measuring 30-48 x 28-40  $\mu\text{m}$ . These spores having multicellular cells are firmly united, giving rise to the "spore balls" (Plate 1. c & d). Spores are polyhedral, hemispherical or broadly wedge-shaped. Similarly, Coutinho *et.al.*, (2006) [2] state that *Thecaphora spilanthes* produced sub-globose spore balls, ovoid or ellipsoid with 30-48 x 28-40  $\mu\text{m}$ , yellowish brown composed of 1-2 to 15 tightly bound spore balls. The genus *Thecaphora* have been documented 63 species (Vánky 2012) [21], infecting 16 different eudicot families (Vánky and Lutz 2007, Roets *et al.* 2008, Vánky *et al.* 2008, Vánky 2012) [19, 8, 18, 21]. With the study of characteristic symptoms and nature of spores, it was confirm that *A. oleracea* gall formation is a smut disease caused by *Thecaphora sp* under the order "Ustilaginales". After consulting the relevant literatures and with the identification report from Herbarium code no. 2022-23/PP/HCIO/03, dated 24.01.2023, IARI, New Delhi Code No, it was verify that the causal organism is *Thecaphora spilanthes* Freire & Vánky causing smut or gall of *A. oleracea*. The present finding represents the first report of *A. oleracea* gall formation or smut caused by *Thecaphora spilanthes* Freire & Vánky in India.



**Fig 1:** Disease incidence (%) of *A. oleracea* gall formation or smut caused by *Thecaphora spilanthes*

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**Conflict of Interest**

The Authors do not have any conflict of interests.

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