

A NEW REPORT ON OCCURRENCE OF FALSE HEAD SMUT [*USTILAGINOIDEA VIRENS* (COOKE) TAKAHASHI] OF MAIZE (*ZEA MAYS* L.) FROM GUJARAT, INDIA

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ABSTRACT

False head smut also known as pseudo-smut, or green smut disease of maize (*Zea mays* L.) has been observed in the Panchmahals and Dahod districts of Middle Gujarat, India during *kharif* 2013. False head smut is categorized as a minor disease due to its sporadic occurrence. It infects only a few isolated male florets in the tassel show dark-green masses of spores (sori). Under bright-field light microscopy, the conidia are found to be round to elliptical and warty on the surface with diameters approximately ranging from 3 to 5 μ m. The pathogen was identified as *Ustilagoideia virens* (Cooke) Takahashi. The disease on maize is not at present of economic importance but it may pose serious threat in reduction of pollen production, if the disease is severe in tassels. A perusal of literature revealed that, this is the first report on occurrence of false head smut of maize [*Ustilagoideia virens* (Cooke) Takahashi] from Gujarat.

INTRODUCTION

An unusual disease of maize (*Zea mays* L.) i.e. false head smut also known as pseudo-smut, or green smut, has been observed in the Panchmahals and Dahod districts of Middle Gujarat, India during *kharif*, 2013. It is categorized as a minor disease due to its sporadic occurrence. The pathogen was identified as *Ustilagoideia virens* (Cooke) Takahashi, which is usually a pathogen of paddy in the major rice-growing countries of the world including India. However, in maize, it has been previously recorded only from the USA and Panama (Haskell and Diehl, 1929) and from Tengnoupal district of Manipur, India.

The pathogen (*Ustilagoideia virens*) belongs to *Ascomycete*. Infection by the fungus transforms individual grains of the panicle into a yellowish smut balls, which changes to yellowish orange, green, olive green and finally to greenish black. The smut balls are often covered by sclerotia that eventually fall to the ground, leaving abundant powdery chlamydospores. *Ustilagoideia virens* is reported to produce both sexual (ascospores) and asexual (chlamydospores) stages in its life cycle with multiple propagules (Singh and Dubey, 1984).

The anamorph form of pathogen, *Ustilagoideia virens* (Cooke) Takahashi, is widely used for description of the causal agent of false smut of rice (Rush *et al.*, 2000) as well as false head smut of maize (Abbas *et al.*, 2002). The teleomorph had been named *Claviceps virens* Sakurai ex Nakata and *Claviceps oryzae-sativae* Hashioka, because the teleomorphic

characteristics of *U. virens* are similar to those of *Claviceps* (Hashioka, 1971). However, Tanaka *et al.* (2008) suggested *Villosiclava virens* as the new name for the teleomorph of *U. virens*, which is accepted and used in recent reports by Ladhakshmi *et al.* (2012) and Fu *et al.* (2012).

False smut of rice and its causal organism have been described in detail by various workers notably by Butler (1913). The disease is common in tropics on related hosts such as *Chionachne koenigii* (Govindarao and Reddy, 1956) and *Oryza officinalis* Wall. (Govindarao and Reddy, 1955). It was reported that *U. virens* also infects *Digitaria marginata*, a common rice weed, which occurs in more than 85% of the rice fields (Shetty and Shetty, 1985). False smut disease was also reported on *Panicum trypheron*, a common grass around paddy fields (Shetty and Shetty, 1987). In addition, the fungus has also been reported to cause the disease in *Echinochloa crusgalli* and *Imperata cylindrica*, two common weeds on irrigation canals in Egypt (Atia, 2004).

On maize, it has previously been reported only from Louisiana and the canal zone of Panama (Haskell and Diehl, 1929). During the course of survey, the occurrence of the disease was recorded on maize in the predominantly maize growing tribal area of Panchmahal and Dahod districts in Gujarat, India to the tune of 1.5 to 2.0 percent, respectively during *kharif*, 2013.

Symptoms and morphology

Symptoms of false head smut (*Ustilagoideia virens*) differ from those of other smuts of maize, as it produces neither

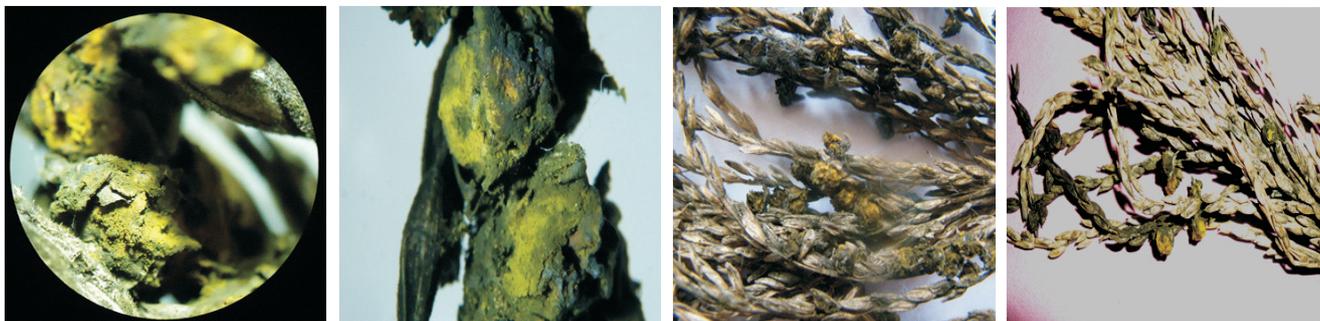


Figure 1 : Yellow and black color smut balls produced by the false smut pathogen, *Ustilagoidea virens* on the tassels of male flowers of maize

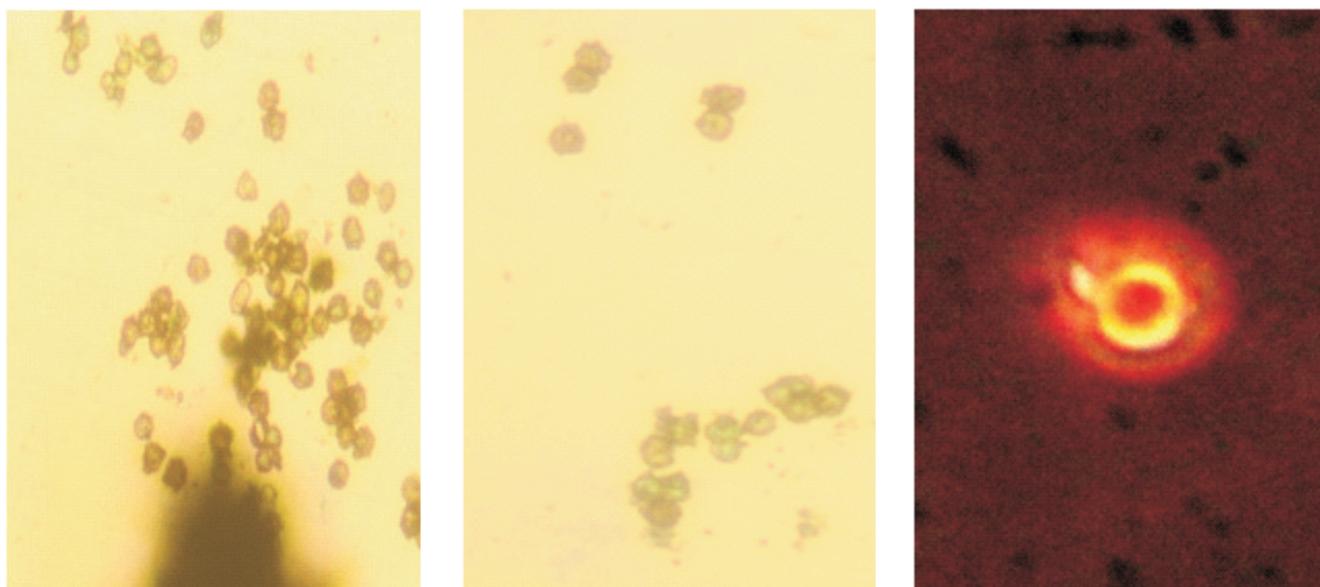


Figure 2 : False smut spores (45x)

tassel malformation nor the ear infection, as does by true head smut (*Sphacelotheca reiliana*); only a few isolated male florets in the tassel show dark-green masses of spores (sori). False head smut also differs from common smut (*Ustilago maydis*) as in that no galls are produced.

The symptoms of the disease as observed were transformation of individual male flowers of the tassel into dark green spore (sori) balls with velvety appearance (Fig. 1). With the gradual maturation of smut balls, the sori diameter increases to between 0.4 to 1.3 cm. usually, the growth of the smut balls is irregular and they become sub-spherical. Fusion of two or more balls occurs and as these mature, the membrane ruptures, leaving the spores naked. Gradually the surface becomes rough. Later, the outer layer, which is golden yellow, is transformed into a dark green layers of spores (Fig. 1). When the spore ball is dissected, the excised portion is seen to be composed of three layers: (i) the outer greenish layer of mature spores, (ii) a light yellowish-green mass composed of mycelium and (iii) an inner yellowish layer consisting of host tissue with growing mycelia and spores. However, no other plant parts including the cob, exhibited any undue abnormality.

The warty and olivaceous spores are borne on minute sterigmata that project from radial hyphae. Under bright-field

light microscopy, the conidia are found to be round to elliptical and warty on the surface with diameters approximately ranging from 3 to 5 μm (Fig. 2). Younger spores are slightly paler in color than mature spores. Germination of the spores in water is by producing the germ tube.

Productions of balls on maize tassels were the typical symptom of the false smut disease. The interiors of the false smut balls were intertwined with hyphae at early stage and then chlamydospores are formed out of these mycelia. The chlamydospores are almost smooth when young and become warty when mature.

The number of rainy days during flowering period influenced the disease incidence more than the amount of rainfall. However, other weather parameters viz., high humidity, wind for dissemination of the spores, overwintering of the pathogen as sclerotia and chlamydospores and flowering stage of the rice crop having false smut coincide with maize crop favour the disease. In addition to rice, maize and gramineae weeds (viz. *Chionachne koenigii*, *Oryza officinalis* Wall. *Digitaria marginata* and *Panicum trypheron*) etc. may act as the hosts of *U. virens* to produce plenty of chlamydospores may act as primary source of infection.

On maize, the disease is not at present of economic importance

but it may pose serious threat in reduction of pollen production, if the disease is severe in tassels.

A perusal of literature revealed that, this is the first report on occurrence of false head smut of maize [*Ustilagoidea virens* (Cooke) Takahashi] from Gujarat. However, it was reported earlier from Tengnoupal district of Manipur, India (Sharma and Verma, 1979).

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