

WITCHE'S BROOM AND PHYLLODY LIKE SYMPTOMS OF DISEASES IN *Acalypha indica* L. AND *Cannabis sativa* L. - A NEW REPORT FROM CHAMPARAN, NORTH BIHAR

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ABSTRACT

During the survey of aromatic and essential oil plants of Champaran, We recorded witche's broom and phyllody like symptoms of diseases in two plants - *Acalypha indica* (Euphorbiaceae) and *Cannabis sativa* (Cannabinaceae). *Acalypha indica* exhibited severe symptoms of witche's broom with numerous leaves of reduced size, shortening of internodes and emergence of several branches from a single point, giving appearance of witche's broom. In *Cannabis sativa* both phyllody and witche's broom symptoms were noted, where flowers of apical region of branches were highly reduced and were of sterile nature, and in most of the flowers, floral parts were converted into green and leafy structures. Causal organism of these diseases has recently been known and it is prokaryotic *Phytoplasma*, which lacks cell wall. The detection of *Phytoplasma in vitro* is difficult, however, PCR technique recently developed by molecular biologists is an unique tool for its identification and confirmation. Recently, near about 600 plant species have been reported, affected by *Phytoplasma*.

KEY WORDS: *Acalypha indica*, *Cannabis sativa*, Champaran, PCR, Phyllody, Phytoplasma

Champaran is well known on global level in the history of India for its "Satyagrah Movement" and had played a major role in the "Freedom Movement of India" led by Mahatma Gandhi, the father of nation in April, 1917. It lies between 26.16'-27.31'N latitude and in between 83.50'-85.18'E longitude, at an elevation of 66.4-135.8 m above sea level and covers an area of 8,404.7Km².

The foot hills of the Himalayan Terai region of the district, touching Nepal was once considered as repository of medicinal plants but now it is losing its identity due to over exploitation and human interference which led to extinction of most of the valuable plants and others are under threat of their extinction. During our survey of aromatic and essential oil plants of Champaran and its neighbouring areas, we recorded witche's broom and phyllody like symptoms of diseases in two plant species of medicinal values, *Acalypha indica* L and *Cannabis sativa* L., both plants are very common in Champaran and grow as weeds in the open waste land where rubbish, garbage and excrement accumulate.

A number of symptoms were observed in both plant species, however, the main symptoms observed in the affected plants include - shortening of internodes, stunted growth, leaves- small in size, pale yellow coloured, more in numbers and arranged in condensed form. Excessive

proliferation of shoots resulting in a witche's broom; phyllody, virescence, sterile flowers, necrosis of the phloem tissues, die back of the branches and the general decline and death of the plants.

MATERIALS AND METHODS

Acalypha indica L. belongs to the Euphorbiaceae family and locally called as 'Kuppi'. It is an annual, erect and herbaceous plant of 30 to 60 cm. in height. The leaves are simple, long petiolate, stipulate with rhomboid ovate lamina of 5.00 X 3.4 cm. in size bearing multicostate reticulate venation. Flowers are minute, arranged in axillary cyme where male flowers are present towards apex of spike, female flowers towards lower parts of spike in clusters of 3-5, subtended by a leafy bract. *Acalypha indica* is an important medicinal plant of the area, widely used by the tribal communities and local *Vaidyas* in treatment of many ailments. It has been traditionally used as anthelmintic, cathartic, insanity, purgative and laxative, also used in ear-ache, snake-bite, scabies as well as in pyorrhoea, eczema, in malarial fever and also in mental disorder (Krishnaiah et al., 2009.)

Cannabis sativa L. a member of family Cannabinaceae, is a tall, branched, robust, annual, dioecious herb of 1.2 m. to 2.0 m. height bearing palmately

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divided leaves with long petiole. Male and female flowers develop on two different plants. Staminate flowers develop on male plant., arranged in long drooping axillary and terminal panicles with few leaves. Pistillate flowers are found on female plant in short axillary leafy spikes. It grows as weed in the open waste land in this district called "Ganza" and "Bhang" and is a major hallucinogenic plant. Medicinal uses of *Cannabis sativa* appears to be limited and its medicinal value is mentioned in our ancient '*Materia Medica*' and is still being used in Ayurvedic and Unani systems of indigenous medicines. The use of *Cannabis sativa* as an intoxicant is always mentioned in old Arabic and Persian writings.

RESULTS AND DISCUSSION

During our study of the infected plants of *Acalypha indica* L. and *Cannabis sativa* L., recorded severe symptoms of witche's broom in *Acalypha indica* in fig a and b while *Cannabis sativa* showed both phyllody and witche's broom symptoms (fig.2a and fig.2b).The characteristic symptoms of Witche's broom as observed in *Acalypha indica* exhibits shortening of internodes, smaller leaves, arranged in condensed form and emergence of several branches from a single point, giving the plant a witche's broom like appearance. The affected plant showed stunted growth, deep blackish-green numerous reduced leaves of shortened petiole in comparison to that of normal and healthy plants. Similarly the phyllody symptoms of *Cannabis sativa* as observed, includes condensed form of leaves which were of reduced size and were pale-yellow in colour. Most of the floral parts or all of the floral parts were transformed into green coloured leafy structures. Remaining flowers showed reduction in their size and were of sterile nature.

In India, phyllody disease was first observed in *Sesamum indicum* in 1930 and was considered as a physiological disease induced by early planting and heavy rainfall. Later, Rehind et al. (1937) suggested that a combination of genetics and environmental conditions caused phyllody in *Sesamum indicum*. However, Pal and Nath (1935) reported that phyllody was caused by a Virus. Doi et al. (1967) during their study on witche's broom and

phyllody diseases in various flowering plants reported that Mycoplasma or PLT group-like organisms are responsible for these diseases and reported their presence in the phloem elements of the infected plants. This finding has clearly discarded the early reports of Pal and Nath (1935) on phyllody disease in *Sesamum*, who considered that it is caused by a combination of genetics and environmental conditions and a viral disease, respectively. Doi et al. (1967) and Maramorosch et al. (1968) made the electron microscopic studies of the ultra thin section of phyllody *Sesamum* phloem tissue and showed the presence of pleomorphic membrane-bounded bodies, similar to that of mycoplasma. No viral particles were observed in either diseased or healthy tissues. Recent studies on phytoplasma made it clear that phytoplasmas are prokaryotes lacking cell walls and are currently classified in the class-Mollicutes. Phytoplasmas are associated with plant disease and till today near about 600 plant species have been reported affected by *Phytoplasma*.

Recent studies on witche's broom and phyllody like diseases have been made by Rangaswamy et al. (2011) in two plant species of medicinal value - *Pergularia daemia* (Asclepiadaceae) and *Verbesine enceliodes* (Asteraceae) and according to them these diseases are caused by *Phytoplasma*. This prokaryotic organism - the *Phytoplasma* remains one of the most poorly characterized group of plant pathogens and its *in vitro* culture is difficult. However, molecular diagnostics in particular, the use of PCR (Polymerase Chain Reaction) has been developed as main tool for confirming the *Phytoplasmas* and for assigning them to taxonomic groups (Gunderson and Lee, 1996). In the last two decades, molecular biological techniques have made it possible to determine the phylogenetic and taxonomic relationship between *Phytoplasmas* and other prokaryotes. Currently, the classification of *Phytoplasmas* is mainly based on the nucleotide sequence of the 16S rRNA (Gunderson et al., 1994, Sawayanagi et al.,1999). PCR amplification of 16S rDNA technology has significantly contributed in the identification and characterization of unidentified *Phytoplasmas*.The animal mycoplasmas are evolutionary distinct from plant pathogenic mycoplasma like organisms have been reported by Lim and Sears (1989) on the basis of

16S r-RNA sequences. Phylogenetic diversity of phytopathogenic mycoplasma like organisms have also been reported by Namba et al. (1983). Parthsarathi and Venkatesan (1982) have reported similar kind of spike disease in Sandal caused by mycoplasma like organisms.

Result of our finding is in favour of findings of Singh (1992), who has earlier reported the witche's broom in bitter gourd caused by MLO. Currently, Rangaswamy et al. (2011) have reported similar symptoms of witche's broom and phyllody in two plant species *Pergularia daemia* and *Verbesine enceliodes* associated with *Phytoplasma* which gives strong support. Shukla and Bhansali (1985) have also observed the grassy shoot disease in sugar-cane similar to that of witche's broom caused by mycoplasma like bodies. Dhumal and Nimbalkar (1982) have also reported similar grassy shoot diseases in sugar-cane cultivars on the basis of

physiological studies of the infected plants.

Thus, the report of our finding of witche's broom and phyllody diseases in *Acalypha indica* and *Cannabis sativa*, proved positive for the presence of *Phytoplasma*, which goes in favour of the recent studies made by Rangaswamy et al. (2011) and others. And it is first reported from Champaran (North Bihar). These diseases besides being causing a direct loss to these two plants of medicinal value, may pose a serious threat of their spread on the other crops of economic importance and plantations growing in the neighbourhood of the infected plant species. Similar results were also observed and reported by Sawayanagi et al. (1999).

Figure 1a & 1b : Show Healthy and Witche's Broom Symptoms in *Acalypha indica*



Figure 2a : Show Phyllody Symptoms in *Cannabis sativa*



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Figure 2b : Show Witche's Broom Symptoms in *Cannabis sativa*



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