*Andhra Pradesh J Agril. Sci* : 9(3): 214-218, 2023

# SURVEY FOR SUNFLOWER LEAF CURL DISEASE INCIDENCE IN ANDHRA PRADESH AND KARNATAKA

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Date of Receipt: 15-07-2023 Date of Acceptance: 21-09-2023

**ABSTRACT**

Leaf curl disease is becoming a significant threat to sunflower cultivation in major growing regions of Andhra Pradesh. A roving survey was conducted in major growing regions of sunflower in Andhra Pradesh and Karnataka during *rabi* season 2022-2023. The major symptoms of sunflower leaf curl disease observed are vein clearing, vein thickening, upward curling of leaves, reduction in the leaf size, enations, stunted growth with reduced ear head resulted poor seed set. The leaf curl disease incidence recorded from 24.80 to 56.30 per cent. Highest disease incidence was noticed in Sunbreed- 275 hybrid (56.30%). The prevalence of leaf curl disease was found to be greater in hybrids of sunflower than varieties. On an average whitefly population per leaf was noticed ranged from six whiteflies. The survey was conducted for the first time on this disease in Andhra Pradesh and advanced research and gaining valuable insights form further studies is crucial.

**KEYWORDS:** Sunflower, survey, leaf curl, begomovirus, percent disease incidence, whitefly.

## INTRODUCTION

Sunflower (*Helianthus annuus* L.) is an annual oilseed crop primarily grown for its edible oil and seeds in temperate and subtropical climates worldwide and native to North America. Sunflower seeds contain different micronutrients, macronutrients, saturated and unsaturated fatty acids, vitamins like B1 and minerals (Skoric *et al.,* 2008). Sunflower oil majorly contains 59% linoleic acid (polyunsaturated omega-6), 30% oleic acid (monounsaturated omega-9), 6% stearic acid and 5% palmitic acid (Avni *et al.,* 2016).The processed sunflower seeds are low in carbohydrates but contain high proteins, dietary fibre, and fatty acids, as well as sources of antioxidants, vitamins, and minerals (Shahbaz *et al.,* 2018).

In India, it is cultivated over an area of 2.90 lakh ha with a production of 2.36 lakh tons and productivity of 0.9 tons/ha (Directorate of Economics and Statistics, 2020). The major sunflower producing states are Karnataka and Maharashtra. In Andhra Pradesh, it is grown in an area of ten thousand ha with a production of ten thousand tons having productivity of 934 kg/ha for the year 2019-20 (Directorate of Economics and Statistics, 2020).

The sunflower crop is attacked by number of pests and diseases from germination to harvest and causes huge loss to the growers. The important sunflower affecting diseases are blight (*Alternaria helianthi*), downy mildew (*Plasmopara helianthi* f.sp *helianthin*), charcoal rot (*Macrophomina phaseolina*), rhizopus head rot (*Rhizopus arrhizus*), sunflower necrosis disease (Saharan *et al.,* 2005). In recent years sunflower area is rapidly declining and among many reasons viral diseases are one of the major contributors. Of the two viral diseases affecting the crop, sunflower necrosis disease caused *Tobacco streak virus* belonging to genus Ilarvirus (Ramaiah *et al.,* 2001) is the major biotic constraints in sunflower production. In the recent past, another viral disease caused by a begomovirus has been observed in Northern Karnataka, producing leaf curl symptoms mainly on Sun breed-275 and KBSH-44 upto 40% and 10% respectively (Govindappa *et al*., 2011). Similar kind of disease symptoms were also observed in Aruna and Swathi hybrids of sunflower predominantly grown in Kurnool district in the past two years where in the disease incidence of 85-90% was recorded. The prominent symptoms are small size, malformed leaves, leaf and veinal thickening, enations and upward leaf curling. Emerging leaves exhibits yellow discolouration and severe reduction in leaf size. The early infected plants are stunted with no ear head emergence (Venkataramanamma *et al.,* 2022). The disease significantly affects the plant height, head diameter, seed weight and oil percentage (Deepa *et al.,* 2015). Leaf curl is known to be caused by Begomovirus having a typical feature of monopartite genome consisting DNA-A (2761 nts) component and the associated satellite beta DNA (1375 nts) (Vanitha, 2012; Govindappa *et al*., 2011; Vanitha *et al.,* 2013; Vindyashree *et al.,* 2016 and

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Anand, 2006). It is a whitefly transmitted virus and the vector attacks numerous fiber (particularly cotton), food, vegetable and ornamental plants apart from sunflower because its polyphagus in nature. Whitefly spreads the begomovirus in persistant circulative manner.

Considering the importance of disease and its severity in recent years of sunflower cultivation, the present survey work was taken up in major growing regions of sunflower in Andhra Pradesh and Karnataka.

## MATERIAL AND METHODS

A roving survey was conducted to record the incidence of Sunflower leaf curl disease in major sunflower growing areas of Andhra Pradesh and Karnataka during *rabi* season, 2022-2023. The districts covered under this study are Kurnool, Prakasam, Kadapa and Nandyal from Andhra Pradesh and Raichur and Bellari from Karnataka.

### Symptoms

In order to study the symptoms of the disease, healthy sunflower plants and sunflower leaf curl infected plants are compared during roving survey from different locations. The symptoms exhibited by the diseased plants were recorded in various stages of crop growth.

### Percent disease incidence (PDI)

The incidence of the disease was recorded during the survey on naturally infected plants by using following equation as suggested by Wheeler (1969). The zigzag pattern is followed to collect required data in which ten randomly selected plants were evaluated at each location.

$$PDI = \frac{\text{Total number of plants infected}}{\text{Total number of plants observed}} \times 100$$

### White fly population

Average white fly population per leaf is obtained from top, middle and bottom leaves from ten randomly selected plants in each field in the above mentioned locations.

## RESULTS AND DISCUSSION

### Symptomatology

The leaf curl disease infected sunflower plants exhibited different kinds of symptoms during various stages of crop. In vegetative stage of crop, symptoms such as vein clearing, vein thickening, upward curling of leaves, reduction in the leaf size and enations on the lower surface of the leaves and stunted growth are appeared. Whereas, poor development of flower and sick appearance of plants are predominately observed in reproductive stage (Fig. 1 and 2) (Table 1). Similar type of symptoms such as curling, malformation of leaves, leaf thickening, leaf enations and severe stunting are reported in sunflower growing regions of Karnataka (Govindappa *et al.,* 2011). Vanitha (2012) studied symptom development by transmitting viruliferous whiteflies on healthy seedling of sunflower. The first visible symptom is vein clearing followed by vein thickening, upward curling of leaves, reduction in the leaf size, enations on the lower surface of the leaves.

### Incidence of Sunflower leaf curl disease

The disease incidence recorded in four districts of Andhra Pradesh and two districts of Karnataka is presented in Table 2 along with stage of crop and varieties or hybrids. The magnitude of the disease incidence ranged from 24.80% to 56.30% and found highly varied with respect to hybrids and varieties. Highest disease incidence was observed in Krishnagiri village (56.30%) of Kurnool district. Lowest disease incidence was noticed in Kadapa district (24.8%). During the survey, the disease incidence noticed in different districts, showed that the disease was more on hybrids (Sunbreed- 275 hybrid in Kurnool) (Table 2). Average disease incidence of 34.96% and 44.28% was observed in Andhra Pradesh and Karnataka respectively. These results are in confirmation with Vanitha (2012) and Govindappa *et al.* (2011) who reported that the disease incidence ranged from 10 to 58 % and noticed variations in disease incidence levels among hybrids and varieties.

**Table 1. Symptoms on various parts on sunflower by leaf curl disease**

| S. No. | Plant part | Symptoms |
|---|---|---|
| 1 | Leaves | Small size, malformed leaves, leaf and veinal thickening, enations, yellow discolouration and upward leaf curling |
| 2 | Head | Reduced head diameter, seed weight and oil percentage |
| 3 | Stem | Stunting |

**a. Vein clearing** **b. Vein thickening and enations** **c. Upward curling**

**Fig. 1. Typical symptoms of sunflower leaf curl disease.**

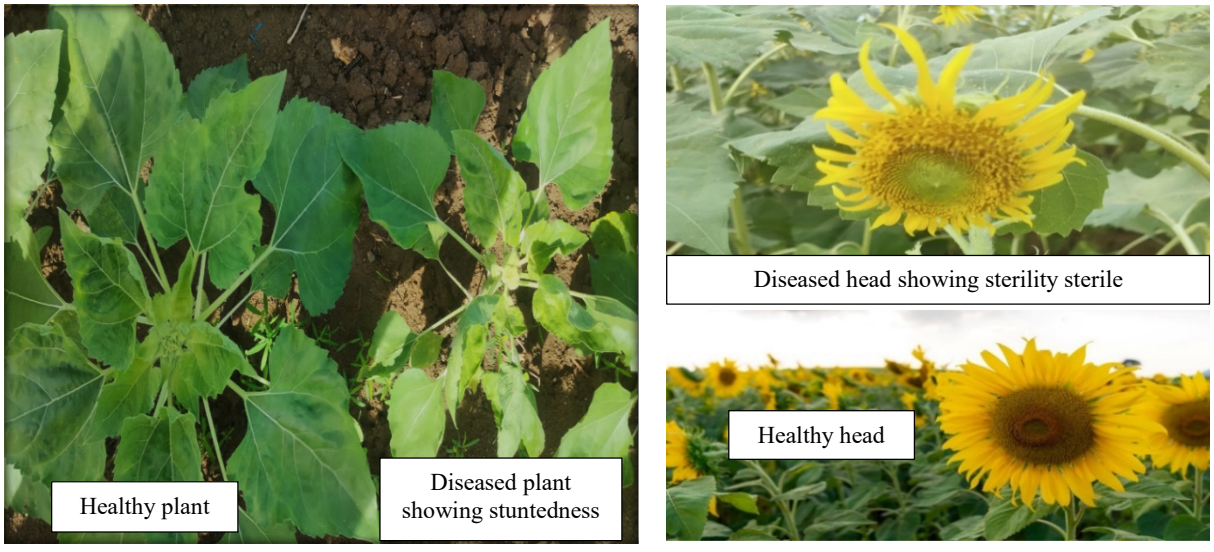


**Fig. 2. Comparison of healthy and infected plants and flower heads.**

**Studies on Whitefly population**

The occurrence of whitefly population in sunflower crop ranged from three to fifteen whiteflies per leaf. Highest population was noticed in Krishnagiri village of Kurnool district (15 whiteflies per plant). Lower population level was recorded in Kadapa district with three whiteflies per plant. Average whitefly population occurred in Andhra Pradesh and Karnataka is nine and seven whiteflies per leaf respectively (Table 3). Vanitha (2012) reported that a single whitefly able to transmit begomovirus with 10 per cent efficiency and transmission efficiency increased to more than 30 per cent when three whiteflies are caged on healthy Sunflower seedlings. Transmission efficiency was 100 per cent when 20 whiteflies per plant are fed. This indicates that the number of insects and the transmission efficiency are positively correlated. Similarly, in the present studies, where high population of whiteflies recorded, more disease incidence of sunflower leaf curl disease (Krishnagiri village of Kurnool district) was observed.

The above study revealed that sunflower leaf curl disease is becoming a serious threat in sunflower cultivation specifically on hybrids which are predominantly grown in Andhra Pradesh and Karnataka. This is clear evident that the average disease incidence is found to be approximately 35% and 44% in AP and Karnataka respectively. Whitefly population is also primary reason for increase the disease incidence in

**Table 2. Survey details of sunflower leaf curl disease in Andhra Pradesh and Karnataka**

| S. No. | Location | District | Stage of crop | Variety(V)/ Hybrid (H) | Type of symptoms | PDI (%) |
|---|---|---|---|---|---|---|
| **Andhra Pradesh** | | | | | | |
| 1 | Krishnagiri | Kurnool | Reproductive | Sunbreed-275 (H) | Upward leaf curling, enations, vein thickening | 56.30 |
| 2 | Allur | Kurnool | Vegetative | Champ (H) | Upward leaf curling | 42.51 |
| 3 | Adhimurthypalli | Prakasam | Reproductive | Sumitra (V) | Stunting, Upward Leaf curling, reduced flower, head diameter | 30.17 |
| 4 | Uyyalawada | Prakasam | Vegetative | Sumitra (V) | Upward leaf curling | 27.24 |
| 5 | B. Pet | Prakasam | Reproductive | Sumitra (V) | Upward leaf curling, poor seed set | 28.66 |
| 6 | Kadapa | Kadapa | Reproductive | Local variety (V) | Upward leaf curling, stunting | 24.80 |
| | | | | | **Mean PDI** | 34.96 |
| **Karnataka** | | | | | | |
| 7 | Raichur | Raichur | Reproductive | KBSH-1(H) | Upward leaf curling, vein thickening | 45.02 |
| 8 | Bellary | Bellary | Vegetative | KBSH-1 (H) | Stunting, Upward leaf curling | 43.54 |
| | | | | | **Mean PDI** | 44.28 |

**Table 3. Details of whiteflies population in surveyed locations in Andhra Pradesh and Karnataka**

| S. No. | Village | District | Number of nymphs per leaf | Number of adult whiteflies per leaf | Total whitefly population |
|---|---|---|---|---|---|
| **Andhra Pradesh** | | | | | |
| 1 | Krishnagiri | Kurnool | - | 15 | 15 |
| 2 | Allur | Kurnool | - | 8 | 8 |
| 3 | Adhimurthypalli | Prakasam | 2 | 8 | 10 |
| 4 | Uyyalawada | Prakasam | 3 | 7 | 10 |
| 5 | Bestavaripet | Prakasam | 2 | 5 | 7 |
| 6 | Kadapa | Kadapa | - | 3 | 3 |
| | | | | **Mean population** | 9 |
| **Karnataka** | | | | | |
| 7 | Raichur | Raichur | - | 8 | 8 |
| 8 | Bellary | Bellary | - | 6 | 6 |
| | | | | **Mean Population** | 7 |

late *rabi* season as whitefly multiplies chiefly during this period which is also major cultivation season for sunflower. This disease has direct impact on reduction of flower head growth, poor seed set and gradually decreases the quality and quantity of oil. Hence, further investigations on characterization of predominant virus associated with the disease and corresponding whitefly biotypes and their prevalence in various seasons needs to be understood to take up effective management of the leaf curl disease.

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