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# INCIDENCE AND SEVERITY OF EYE LEAF SPOT DISEASE OF BANANA IN COASTAL ANDHRA PRADESH, INDIA

**M. Aswini[1]*, A. Snehalatharani[2], S. Narasimha Rao[3] and K. Ravindra Kumar[4]**

[1]Department of Plant Pathology, Dr. YSRHU College of Horticulture, Venkataramannagudem, Andhra Pradesh, India.
[2]Department of Plant Pathology, Dr. YSRHU- Regional Horticultural Research Station, Kovvur, Andhra Pradesh, India.
[3]Department of Plant Pathology, Dr. YSRHU- College of Horticulture, Chinnalataripi, Andhra Pradesh, India.
[4]Department of Horticulture, Dr. YSRHU- Regional Horticultural Research Station, Kovvur, Andhra Pradesh, India.
*Corresponding author E-mail : maddukuriaswini@gmail.com

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**ABSTRACT**

Banana (*Musa* spp.) is an important commercial fruit crop in Andhra Pradesh, contributing significantly to the state's agricultural economy and providing income to a large number of farming communities. Foliar diseases are one of the major constraints reducing the yield in banana. Eye leaf spot is an emerging foliar disease gaining economic importance in changing climatic conditions. *Drechslera gigantea* and *Exserohilum rostratum* has been reported as the causal organism of the disease. In the present study, a systematic field survey was conducted during 2025–2026 to assess the occurrence, distribution and intensity of eye leaf spot in major banana-growing areas of coastal Andhra Pradesh. Four villages were surveyed from two mandals within each district and per cent incidence, per cent disease index and youngest leaf spotted was calculated. Eye leaf spot was observed in all the surveyed districts, with considerable variation in disease severity. The highest mean disease incidence (24.83%) and severity (14.53%) were recorded in East Godavari district, whereas the lowest mean disease incidence (8.36%) was recorded in Anakapalli (erstwhile Visakhapatnam) district and the lowest disease severity (4.55%) in Vizianagaram district. Among the twelve mandals surveyed, Kovvur mandal of East Godavari recorded the highest mean disease incidence (31.66%) with disease severity of 17.41%. The survey provided baseline information on the current distribution and intensity of the disease in coastal Andhra Pradesh supporting further epidemiological studies and the development of effective management strategies.

***Key words :*** Banana, Coastal Andhra Pradesh, Disease incidence, Eye leaf spot, Per cent disease index.

## Introduction

Banana (*Musa* spp.) is a globally significant fruit crop, serving as a vital source of food, nutrition and income for millions of people in tropical and subtropical regions. It ranks as the fourth most economically important food crop after rice, wheat and maize. Currently, India stands as the world's largest producer of banana, followed by China, Indonesia, Brazil and the Philippines (George *et al*., 2025).

In India, banana is one of the most important fruit crops and plays a significant role in the country's horticultural economy, ranking first in production and third in area among fruit crops. This crop spans approximately 13.42% of the country's total fruit-growing area and drives nearly 33.35% of the total fruit production (IASRI, 2025). Maharashtra is the top banana producing state, with a production of 7,800.0 thousand tonnes, followed by Andhra Pradesh. Other major banana producing states are Tamil Nadu, Uttar Pradesh, Gujarat and Karnataka (NHB, 2026). Banana is cultivated throughout the year and contributes significantly to both domestic consumption and export market. The crop is highly significant in Andhra Pradesh as a major fruit crop, crucial for economy, especially in districts like YSR Kadapa, West Godavari, East Godavari and Anantapur, with the export-oriented Grand Nain cultivar being the key for boosting state revenue.

However, the crop's production threshold faces persistent challenges from various biotic and abiotic stresses, with fungal diseases posing a major constraint to economic production. Major fungal diseases include sigatoka disease complex and panama wilt that severely reduce qualitative and quantitative yield. Bacterial rhizome rot or tip-over disease affect young plantations and cause rapid plant death. Viral diseases like Banana Bunchy Top disease and Banana Streak Virus disease lead to systemic infections and stunted growth. Recently, leaf spot diseases such as Cordana leaf spot, *Corynespora* leaf spot, *Pestalotiopsis* leaf spot, *Bipolaris* leaf spot, *Cladosporium* speckle, *Septoria* leaf spot, *Phaeoseptoria* leaf spot and eye leaf spot are increasingly reported in many regions, affecting photosynthetic area and predisposing factors to secondary infections.

Although, sigatoka disease complex have been extensively investigated, comparatively limited information is available on other emerging fungal leaf spot diseases, particularly eye leaf spot disease. Eye leaf spot of banana was first described by Meredith (1963) in Jamaica and was associated with *Drechslera gigantea* (Heald & Wolf). However, the similar symptoms were reported by Lin *et al.* (2011) in banana, which were also associated with *Exserohilum rostratum*. The disease was characterized by circular to elliptical lesions with a pale grey or whitish centre surrounded by a dark brown margin, producing the characteristic "eye spot" appearance. Often the dense spots coalesce into larger blotches, potentially destroying mesophyll tissue and severely impacting the plant's physiological functions and overall productivity. Although eye leaf spot disease of banana is observed in several banana-growing regions of Andhra Pradesh, systematic information on its incidence, severity and distribution across the region is limited. Therefore, the present study was undertaken to assess the prevalence of eye leaf spot disease in major banana-growing areas of coastal Andhra Pradesh, with emphasis on documenting the incidence and severity of the disease, cultivar preference, crop age and its distribution across different geographical regions.

## Materials and Methods

A roving survey was conducted during 2025-2026 in the months of December, January and February to assess the disease incidence and severity of Eye leaf spot in major Banana growing districts of coastal Andhra Pradesh *i.e.*, East Godavari, West Godavari, Dr. BR Ambedkar Konaseema, Eluru, Vizianagaram and Anakapalli (erstwhile Visakhapatnam) districts.

Survey was conducted in four villages of six districts and two fields per each village. Ten plants each at five locations *i.e.*, at four corners and one at centre of the field were selected for recording the incidence of eye leaf spot of banana. Per cent disease index of each field was calculated, mean for each mandal and district was worked out. Per cent incidence and per cent disease index were calculated using the following formulae:

$$\text{Per cent incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \times 100$$

Youngest leaf spotted (YLS) was calculated by recording the youngest fully unfurled leaf (YLS) for leaf spot development in the observed plants. The leaf number was recorded by counting from the youngest fully unfurled leaf downwards and the observations were used to assess the distribution of disease symptoms on different leaf ages.

Disease severity on leaves was assessed using 0 to 6 point scale method (Gaul's modification of Stover's scoring system, 1989).

| Severity rating | Percentage of leaf area affected |
|---|---|
| **0** | No symptoms |
| **1** | <1% leaf area with streaks or <10 spots |
| **2** | 1% to 5% leaf area affected |
| **3** | 6% to 15% leaf area affected |
| **4** | 16% to 33% leaf area affected (medium patches) |
| **5** | 34% to 50% leaf area affected (large patches) |
| **6** | 51% to 100% leaf area affected (severe blighting/death) |

$$\text{PDI} = \frac{\text{Sum of individual disease ratings}}{\text{No. of observations assessed} \times \text{maximum disease rating}} \times 100$$

During survey, banana leaves showing typical symptoms of leaf spot disease were collected for isolation of pathogen and for further studies.

## Results and Discussion

### Symptomatology

Eye leaf spot disease of banana was characterized by the development of distinct lesions on the leaves, which varied in size, shape and colour with disease progression. Initially, minute reddish spots appeared on the leaf lamina, surrounded by a pale green or faint yellow border. The lesions gradually enlarged and became oval or pear-shaped, particularly along the direction of the leaf veins (Fig. 1). With further disease development, the centre of the lesions became bleached white to greyish-white and was surrounded by a narrow dark brown margin with a



**Fig. 1 :** Typical symptom of eye leaf spot disease on Banana.

pale green or yellowish-green halo, giving the lesions a characteristic eye-like appearance. The lesions measured up to 2.0 × 1.4 cm in length and breadth. Under severe disease conditions, individual lesions coalesced to form large blighted and necrotic areas, eventually leading to extensive leaf tissue death. Similar symptoms in banana (Meredith, 1963; Dahab *et al.*, 1983; Lin *et al.*, 2011; Silva *et al.*, 2008) were reported, earlier by the researchers.

**Eye leaf spot of banana occurrence in coastal Andhra Pradesh**

Survey on eye leaf spot disease of banana was carried out in six districts of coastal Andhra Pradesh during 2025–2026. The location-wise data of coastal Andhra Pradesh on disease incidence, severity and youngest leaf spotted of banana eye leaf spot have been presented in Table 1.

Incidence, severity and youngest leaf spotted of eye leaf spot was assessed in two fields of a village, two villages in a mandal and two mandals in East Godavari, West Godavari, Eluru, Dr. B.R. Ambedkar Konaseema, Vizianagaram and Anakapalli (erstwhile Visakhapatnam) districts of Andhra Pradesh. In the surveyed fields, per cent incidence, per cent disease index and youngest leaf spotted was calculated. Diseased samples were collected from all six districts for further studies.

Eye leaf spot was observed in all surveyed districts and varied in its intensity. Of the districts surveyed the highest disease incidence of 24.83% was observed in East Godavari district whereas the lowest disease incidence of 8.36% was observed in Anakapalli (erstwhile Visakhapatnam) district. The disease incidence range from 13.00 to 43.33% in East Godavari, 12.33 to 22.00% in West Godavari, 11.00 to 19.00% in Eluru, 15.00 to 27.64% in Dr. B. R. Ambedkar Konaseema, 10.00 to11.25% in Vizianagaram and 5.60 to 9.84% in Anakapalli (erstwhile Visakhapatnam) districts.

A similar trend was observed with respect to disease severity across six districts surveyed. The highest mean disease severity was recorded in East Godavari (14.53%), followed by Dr. B.R. Ambedkar Konaseema district (12.43%), whereas the lowest mean disease severity was observed in Visakhapatnam district (6.02%). The disease severity ranged from 5.60 to 21.30% in East Godavari, 6.10 to 14.42% in West Godavari, 5.42 to 11.87% in Eluru, 9.07 to 17.50 % in Dr. B.R. Ambedkar Konaseema, 1.96 to 6.19% in Vizianagaram and 4.17 to 9.29% in Anakapalli (erstwhile Visakhapatnam) districts (Tables 1 and 2).

Disease incidence and severity varied differentially within and among the mandals surveyed. Among the twelve mandals surveyed, Kovvur mandal in East Godavari district was recorded as the highest mean disease incidence (31.66%) and severity (17.41%), whereas Rolugunta mandal in Anakapalli (erstwhile Visakhapatnam) district recorded the lowest mean disease incidence (7.72%) and Srungavarapukota in Vizianagaram district recorded the lowest mean disease severity (3.45%). The mean disease incidence among the mandals ranged from 7.72% to 43.33%, while disease severity ranged from 3.45 to 17.41% across twelve mandals.

Youngest leaf spotted (YLS) is an indicator to measure the severity of foliar diseases in banana. It is the position of the youngest open leaf that has disease lesions. So, the YLS for eye leaf spot disease was also recorded during the surveys. The youngest leaf spotted (YLS) also varied across the surveyed locations, with disease

**Table 1 :** Banana eye leaf spot incidence, severity and youngest leaf spotted in different districts of Andhra Pradesh.

| District | Incidence (%) | | Severity (PDI) | | Youngest leaf spotted (YLS) |
|---|---|---|---|---|---|
| | Range | Mean | Range | Mean | Mean |
| East Godavari | 13.00-43.33 | 24.83 | 5.60-21.30 | 14.53 | 5.2 |
| West Godavari | 12.33-22.00 | 15.58 | 6.10-14.42 | 9.18 | 5.2 |
| Eluru | 11.00-19.00 | 15.00 | 5.42-11.87 | 9.57 | 5.9 |
| Dr. B. R. Ambedkar Konaseema | 15.00-27.64 | 19.66 | 9.07-17.50 | 12.43 | 5.1 |
| Vizianagaram | 10.00-11.25 | 10.50 | 1.96-6.19 | 4.55 | 8.0 |
| Anakapalli (erstwhile Visakhapatnam) | 5.60-9.84 | 8.36 | 4.17-9.29 | 6.02 | 7.7 |

**Table 2 :** Prevalence of eye leaf spot disease in major banana growing districts of Andhra Pradesh.

| District | Mandal | Village | Coordinates | Disease incidence (%) | Disease severity (%) | YLS | Variety | Month of the crop | Irrigation | Type of the crop | Previous crop | Field surrounded by |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East Godavari | Kovvur | Kovvur | 17.0045 °N 81.7309 °E | 43.33 | 13.53 | 6.5 | Grand nain | 3 - 5 | Flood | Sole (Ratoon) | Banana | Banana |
| | | Thogummi | 16.9765 °N 81.7387 °E | 20.00 | 21.30 | 4.5 | K.C.keli | 3 | Flood | Sole | Banana | Elephant foot yam |
| | **Mandal Mean** | | | **31.66** | **17.41** | **5.5** | | | | | | |
| | Undrajavaram | Dammennu | 16.8225 °N 81.7070 °E | 13.00 | 5.60 | 4.1 | K.C.keli | 2 - 4 | Flood | Sole (Ratoon) | Banana | Banana |
| | | Mortha | 16.8102 °N 81.7056 °E | 23.00 | 17.85 | 5.7 | Bontha | 2 - 3 | Flood | Intercrop with Coconut | Coconut | Coconut, Cocoa, Napier grass |
| | **Mandal Mean** | | | **18.00** | **11.72** | **4.9** | | | | | | |
| | **District Mean** | | | **24.83** | **14.53** | **5.2** | | | | | | |
| West Godavari | Palakollu | Kapavaram | 16.5501 °N 81.6967 °E | 15.00 | 6.10 | 6.1 | K.C.keli | 2 - 4 | Flood | Sole | Banana | Paddy |
| | | Chintaparru | 16.5314 °N 81.6939 °E | 12.33 | 8.36 | 5.7 | K.C.keli | 2 - 5 | Flood | Sole | Paddy | Paddy. Coconut |
| | **Mandal Mean** | | | **13.66** | **7.23** | **5.9** | | | | | | |
| | Penugonda | Vadali | 16.6731 °N 81.7836 °E | 13.00 | 7.87 | 4.8 | K.C.keli | 3 | Flood | Sole | Paddy | Paddy, Coconut |
| | | Siddantham | 16.6850 °N 81.7920 °E | 22.00 | 14.42 | 4.2 | K.C.keli | 1 - 5 | Flood | Sole (Ratoon) | Ivy gourd | Banana, Coconut, Ivy gourd, Bottle gourd |
| | **Mandal Mean** | | | **17.50** | **11.14** | **4.5** | | | | | | |
| | **District Mean** | | | **15.58** | **9.18** | **5.2** | | | | | | |
| Eluru | Dwaraka Tirumala | Anjaneya nagaram | 16.8449 °N 81.2521 °E | 11.00 | 10.11 | 7.1 | T.C.keli | 3 - 4.5 | Drip | Sole | Banana | Oil palm, Banana, Paddy, Maize |
| | | Pangidigudem | 16.8777 °N 81.2457 °E | 14.00 | 5.42 | 5.9 | K.C.keli | 2 - 5 | Drip | Sole (Ratoon) with suckers | Banana | Cocoa, Coconut, Banana, Paddy |
| | **Mandal Mean** | | | **12.50** | **7.76** | **6.5** | | | | | | |
| | Kamavaapukota | Kamavarapukota | 17.0036 °N 81.1991 °E | 19.00 | 11.87 | 4.5 | T.C.keli | 2 - 3 | Drip | Sole (Ratoon) with more suckers | Corn | Banana |
| | | Tadikalapudi | 16.9407 °N 81.1975 °E | 16.00 | 10.91 | 6.4 | K.C.keli | 3- 3.5 | Drip | Sole | Corn | Sugar cane, Casuarina, Banana |
| | **Mandal Mean** | | | **17.50** | **11.39** | **5.4** | | | | | | |
| | **District Mean** | | | **15.00** | **9.57** | **5.9** | | | | | | |

***Table 2 continued...***

***Table 2 continued...***

| District | Mandal | Village | Coordinates | Disease incidence (%) | Disease severity (%) | YLS | Variety | Month of the crop | Irrigation | Type of the crop | Previous crop | Field surrounded by |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dr. B. R. Ambedkar Konaseema | Athreyapuram | Ryali | 16.7787 °N 81.8147 °E | 27.64 | 13.64 | 4.7 | K.C.keli | 1 - 2 | Flood | Intercrop with coconut and cocoa | Banana | Banana, Cocoa, Coconut, Paddy |
| | | Merlapalem | 16.7823 °N 81.8151 °E | 15.00 | 9.07 | 5.8 | T.C.keli | 3 - 4 | Flood | Sole | Corn | Banana, Coconut, Elephant foot yam |
| | **Mandal Mean** | | | **21.32** | **11.35** | **5.2** | | | | | | |
| | Ravulapalem | Ethakota | 16.7283 °N 81.8304 °E | 20.00 | 9.55 | 5.3 | T.C.keli | 2 - 3 | Flood | Sole | Elephant foot yam | Banana, Coconut, Napier grass, Marigold, Sugar cane |
| | | Lakshmi Polavaram | 16.7520 °N 81.8273 °E | 16.00 | 17.50 | 5.0 | Martaman | 3 - 4 | Flood | Sole | Elephant foot yam | Banana, Paddy, Coconut, Coriander |
| | **Mandal Mean** | | | **18.00** | **13.52** | **5.1** | | | | | | |
| | **District Mean** | | | **19.66** | **12.43** | **5.1** | | | | | | |
| Vizianagaram | Gantyada | Thatipudi | 18.1661 °N 83.1979 °E | 10.00 | 5.11 | 8.0 | K.C.keli | 4 - 5 | Flood | Sole | Banana | Sugar cane, Banana, Tomato |
| | | Madhanapuram | 18.1661 °N 83.1981 °E | 12.00 | 6.19 | 8.0 | T.C.keli | 4 - 5 | Flood | Sole (Ratoon) | Banana | Sugar cane, Coconut, Watermelon, Sweet potato, Papaya |
| | **Mandal Mean** | | | **11.00** | **5.65** | **8.0** | | | | | | |
| | Sungavarapu Kota | Kiltampalem | 18.1689 °N 83.1379 °E | 11.25 | 4.94 | 6.1 | Grand nain | 3 - 4 | Flood | Sole | Banana | Banana, Cocoa, Lemon, Jack fruit, Sapota |
| | | Gowripuram | 18.1167 °N 83.1667 °E | 8.75 | 1.96 | 10.1 | K.C.keli | 5 | Flood | Sole | Paddy | Sugar cane |
| | **Mandal Mean** | | | **10.00** | **3.45** | **8.1** | | | | | | |
| | **District Mean** | | | **10.50** | **4.55** | **8.0** | | | | | | |
| Anakapalli (erstwhile Visakhapatnam) | Golugunta | Y.G. Peta | 17.7453 °N 82.5763 °E | 9.00 | 9.29 | 6.9 | Grand nain | 3 - 4 | Flood | Sole | Chilli, Tomato | Paddy, Casuarina, Banana |
| | | Komira | 17.7365 °N 82.5770 °E | 9.00 | 4.46 | 7.8 | Grand nain | 3 - 4 | Flood | Sole | Tomato | Casuarina, Vegetables, Banana |
| | **Mandal Mean** | | | **9.00** | **6.87** | **7.3** | | | | | | |
| | Rolugunta | M.K. Patnam | 17.7495 °N 82.5864 °E | 9.84 | 4.17 | 8.8 | K.C.keli | 3 - 4 | Flood | Intercrop with oil palm | Oil palm, Banana | Banana, Oil palm, Coconut, Eucalyptus |
| | | Rolugunta | 17.6645 °N 82.6155 °E | 5.60 | 6.18 | 7.6 | K.C.keli | 2 - 5 | Flood | Sole | Banana | Eucalyptus, Oil palm, Banana, coconut, Tomato |
| | **Mandal Mean** | | | **7.72** | **5.17** | **8.2** | | | | | | |
| | **District Mean** | | | **8.36** | **6.02** | **7.7** | | | | | | |

K.C.keli - Karpura chekkarakeli (AAB) T.C. keli - Tella chekkarakeli (AAA) Bontha – (ABB) Grand nain – (AAA) Martaman – (AAB)

symptoms appearing from the 3rd to the 10th leaf. Among the districts surveyed for eye leaf spot disease incidence on youngest leaf spotted, it was highest in Vizianagaram (8.0) and Anakapalli (erstwhile Visakhapatnam) (7.7) districts when compared to other districts. YLS in other four districts was range between 5.1 to 5.9, indicating the severity of the disease. During the surveys, eye leaf spot disease was observed in most of the commercial banana cultivars of Andhra Pradesh *viz.*, Grand Nain, Karpura Chekkarakeli, Tella Chekkarakeli, Bontha and martaman (Table 2).

Among the varieties, disease incidence was recorded as 18.14% in Grand Nain, 14.39% in Karpura Chekkarakeli and 15.40% in Tella Chekkarakeli. The variation in disease incidence, severity and YLS among the surveyed locations may be associated with differences in banana variety, crop age and prevailing environmental conditions.

Overall, the comparatively higher disease incidence observed in East Godavari district, had extensive banana cultivation, with banana being the major surrounding crop and fields occurring in close proximity. Banana fields adjacent to Napier grass also showed comparatively higher disease incidence and severity. Ratoon crops, in which the previous banana crop was retained alongside newly emerging sucker plants, exhibited comparatively greater disease incidence and severity. Similar observations have been reported for *Exserohilum turcicum* in maize, where crop residues supported pathogen survival and served as a source of inoculum for infection in the subsequent season (Montemarani *et al*., 2018).

Further, in a field a significantly higher disease incidence and severity was observed along the field margins and corners may due to the heavy presence of weeds, which act as critical alternative hosts. This specific increase in disease severity near field borders is closely linked to the polyphagous nature of the *Exserohilum* pathogen, which exhibits a broad host range predominantly across wild monocotyledonous grasses and collateral weed species (Lin *et al*., 2011).

Earlier literature shows that the global incidence of eye leaf spot disease was relatively low, recorded at just 4.16% by Amani *et al*. (2014) in Iran, the findings of this present study reveal a substantial increase in disease incidence, ranging from 5.60% to 43.33% and the disease severity range from 1.96% to 21.30%. This upward trend strongly suggests that shifting environmental conditions have become highly favourable for the pathogen, thereby driving higher infection rates and accelerating its development across host species.

## Conclusion

The present survey confirmed the occurrence of banana eye leaf spot disease across key growing regions of coastal Andhra Pradesh, revealing considerable variation in disease incidence and severity. These findings underscore the need for regular monitoring and timely intervention. Further research on the epidemiology and disease development is essential to establish effective management strategies and safeguard regional banana production.

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**Conflict of interest :** The authors declare no conflict of interest.

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