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STATUS OF EMERGING VIRUS DISEASE CAUSING NECROSIS IN COTTON INCITED BY TOBACCO STREAK VIRUS IN NORTH EASTERN KARNATAKA INDIA

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ABSTRACT

Cotton (*Gossypium* spp. L.), often referred to as “white gold,” is a major cash crop and the primary source of natural fibre for the textile industry, contributing substantially to India’s economy. Despite its economic importance, cotton is susceptible to a wide range of biotic stresses, including viral diseases. Among these, tobacco streak virus (TSV)-induced necrosis has recently emerged as a major constraint, particularly in southern India. A systematic survey was conducted during *kharif* 2024-25 across five districts of North Eastern Karnataka *viz.,* Raichur, Ballari, Koppal, Yadgir and Chitradurga to assess the occurrence, distribution, and symptomatology of cotton necrosis disease. Disease incidence ranged from 9.00% to 56.00%, with the highest levels recorded in hybrids RCH 659 BG II at Bheemarayanagudi (Yadgir) and Kaveri at Gollalingammanahalli (Ballari). Characteristic field symptoms included chlorotic and necrotic leaf spots with purplish-brown discoloration, veinal necrosis, leaf drying, stem necrosis, and stunted growth. Mechanical inoculation of symptomatic cotton leaf extracts onto cowpea (cv. 152) successfully reproduced the typical symptoms, confirming TSV as the causal agent. Disease severity was influenced by cultivar susceptibility, the presence of alternate hosts, and thrips vectors. These findings highlight TSV as an emerging threat to cotton production and emphasize the need for integrated management strategies, including regular field surveillance, vector control, eradication of alternate hosts, and development of resistant cultivars to minimize yield losses.

Keywords **:** Cotton necrosis disease; Tobacco streak virus; Symptomatology; Mechanical inoculation; Thrips; North Eastern Karnataka.

Introduction

Cotton, often referred to as "white gold," is a vital cash crop for India's economy. Belonging to the *Malvaceae* family. Globally, cotton is the most important natural fibre crop used in textiles, comprising around 50 per cent of the fibre utilized in the textile industry. However, the crop is susceptible to various fungal, bacterial and viral diseases. Among the viral diseases infecting cotton, cotton leaf curl virus and tobacco streak virus are important. However, in recent years, cotton necrosis disease has been overtaking cotton leaf curl disease and has become a major threat to cotton cultivation, especially in southern India and it has been discovered that, TSV can cause necrosis of the vein, petiole, stem, and other components in cotton (*Gossypium hirsutum*), mung bean (*Phaseolus aureus*), and sunhemp (*Crotalaria juncea*) (Nakkeeran, 2010; Jagtap *et al*., 2012; Rageshwari *et al*., 2016; Vinodkumar *et al.,* 2017 and Manjunath *et al.,* 2023). Rageshwari *et al*. (2016) reported Tobacco streak virus (TSV), the causal agent of cotton necrosis, was identified as an emerging threat in Tamil Nadu, with all surveyed cotton varieties and hybrids found susceptible.

Tobacco streak virus (TSV), a member of the genus Ilarvirus within the family Bromoviridae, is a

multipartite, single-stranded, positive-sense RNA virus. Fulton (1948 &1985) It has a broad host range encompassing more than 200 plant species, including agricultural, horticultural crops and weeds. Johnson (1936) and Costa (1945) TSV was first identified in tobacco in Brazil. In India, it was initially reported in sunflower (Prasada Rao *et al*., 2000) and peanut (Reddy *et al.,* 2002), where it caused necrosis disease. The first report of TSV association with cotton in Tamil Nadu was made by Nakkeeran (AICRP Report 2010). Sharman (2009) and Jagtap *et al*. (2012) reported that TSV has been documented to spread through mechanical transmission, infected seeds, and *via* thrips species. Tobacco streak virus (TSV), though extensively studied in several host plants, has been sparsely documented in cotton (Costa, 1945; Prasada Rao *et al*., 2009; Jagtap *et al*., 2012; Rageshwari *et al*., 2016). Reports indicate that TSV infection in cotton can cause yield losses up to 62.7 per cent (Rageshwari *et al*., 2017). Recognizing its emergence as a potential threat to cotton cultivation in southern India, particularly in Karnataka, the present study was undertaken at the University of Agricultural Sciences, Raichur, Karnataka, India. This paper focuses on the occurrence and distribution of tobacco streak virus (TSV) induced necrosis in cotton across North Eastern Karnataka, emphasizing its characteristic symptomatology and confirming transmission through mechanical inoculation.

Material and Methods

Occurrence and distribution of Tobacco streak virus in different cotton growing areas of Karnataka

Survey was carried out to assess the status of necrosis disease incidence on cotton in different parts of Karnataka. The observations on disease incidence, type of symptoms, stage of infection, varieties grown and presence of alternate weeds around the crop were recorded. Totally, five districts *viz*., Raichur, Ballari, Koppal, Yadgir and Chitradurga was surveyed during *kharif* 2024-25. In each district, two taluks were selected and from each taluk two villages and in each village two cotton plots of 10 X 10 Sq. Mt. areas were observed for the disease incidence. The disease incidence was calculated based on the following formula and the incidence on cotton hybrids was graded as per the scale (0 to 5) (Bhat and Rao, 2014).

$$\text{Disease incidence}\,(\%) = \frac{\text{Number of infected plants observed}}{\text{Total number of plants observed}} \times 100$$

Symptomatology

The developmental stages of cotton necrosis disease symptoms on different parts of cotton plants were systematically observed during various crop growth stages and the detailed characteristic features of the symptoms are described in the results section along with the respective photographs.

Mechanical transmission

Young cotton leaves expressing the typical symptom of TSV were collected, washed with tap water and dried in blotting paper. Later, the leaves were weighed and extracted (1:5 w/v leaf sample and buffer) buffer combination (0.5M $KH_2PO_4.2H_2O$ + 0.5M K_2HPO_4+ 0.1 % Na_2SO_3+ 0.01% Na_2 EDTA + 0.1% β-mercaptoethanol) in a pre-chilled pestle and mortar. The extract was filtered with double layered muslin cloth. Cotton pad soaked in standard leaf extract was rubbed on the leaves of test plants *viz*., cowpea (*cv* 152) after dusting with abrasive carborundum (240/1200 grit). The plants were washed with water to remove excessive carborundum particles after one minute. The inoculated seedlings were labeled properly and kept for observation in the glasshouse. The control plants were treated similarly using neutral phosphate buffer solution only. The inoculated plants were placed in insect proof cages and continuously observed for symptom expression.

Results and discussion

Occurrence and distribution of Tobacco streak virus in different cotton growing areas of Karnataka

During the survey, the observations clearly indicated that, cotton necrosis disease was prevalent in all the surveyed regions, though the degree of incidence varied considerably from one district to another. The district overall incidence ranged from 15.75 to 40.30 per cent, highlighting a moderate to severe level of infection in several areas. Among the districts surveyed, Yadgir recorded the highest incidence (40.30%), which is followed by Ballari (36.60%), Chitradurga (28.25%) and Raichur (27.38%). In contrast, the lowest incidence was observed in Koppal district (15.75%) (Table 1; Fig. 1 & 2).

The incidence of cotton necrosis disease ranged from 9.00 to 56.00%, with the highest recorded in hybrid RCH 659 BG II at Bheemarayanagudi (Yadgir) and Kaveri at Gollalingammanahalli (Ballari). The elevated incidence may be attributed to cultivar susceptibility and the presence of alternate hosts like sunflower, groundnut, and weeds such as *Parthenium* and *Cassia* spp., known reservoirs of tobacco streak virus and thrips. The lowest incidence (9.00%)

occurred in hybrid Kanaka at Khanapur (Raichur), where surrounding crops were non-hosts of thrips and TSV. A decline in disease incidence after 90 DAS was likely due to favourable weather changes and post-transcriptional recovery.

Earlier reports on survey conducted to assess the incidence of tobacco streak virus (TSV) induced diseases in cotton across various regions of India have reported variable infection levels. Rageshwari *et al.* (2016) reported that it varied between 1 and 50 per cent in Tamil Nadu. Manjunath *et al.* (2023) studied the occurrence of cotton necrosis disease in all cotton growing regions of Karnataka, with an average incidence ranging from 16.7 per cent to 38.76 per cent.

Table 1 : Prevalence of cotton necrosis disease in five districts of Karnataka during kharif 2024-25

District	Taluk	Village	No. of fields visited	Stage of the crop	Disease incidence (%)	Mean disease incidence (%)	
						Taluk	District
Raichur	Raichur	Khanapur	2	Boll formation	10.50	19.91	27.38
		Mamdapur	2	Vegetative	16.00		
		Nelhal	2	Vegetative	11.00		
		Manjerla	2	Boll formation	24.00		
		Yeragera	2	Flowering	31.00		
		Sultanpur	2	Boll formation	27.00		
	Devadurga	Gabbur	2	Boll formation	30.00	24.33	
		Bunkaldoddi	2	Vegetative	23.00		
		Navilgudda	2	Flowering	20.00		
	Manvi	Kurdi	2	Vegetative	41.00	43.00	
		Kapgal	2	Vegetative	45.00		
	Sirwar	Kallur	2	Vegetative	40.50	38.75	
		Athnur	2	Boll formation	37.00		
Ballari	Ballari	Hagari	2	Vegetative	31.00	34.12	36.60
		Ibrahimpura	2	Flowering	42.50		
		Sanganakallu	2	Vegetative	27.00		
		Koluru	2	Flowering	36.00		
	Sandur	Sovenahalli	2	Boll formation	21.00	36.33	
		Gollalingammanahalli	2	Flowering	51.00		
		Motalakunta	2	Flowering	37.00		
	Siruguppa	Sirigeri	2	Vegetative	37.00	38.33	
		Talur	2	Vegetative	46.00		
		Siddaramapura	2	Vegetative	32.00		
Koppal	Koppal	Budugumpa	2	Boll formation	18.50	16.50	15.75
		Hampasadurga	2	Flowering	14.50		
	Kushtagi	Tawargera	2	Flowering	16.00	15.00	
		Hagaldhal	2	Flowering	14.00		
Yadgir	Yadgir	Mailapur	2	Boll formation	32.00	34.50	40.30
		Balichakkar	2	Boll formation	37.00		
	Shahapur	Doranahalli	2	Flowering	39.00	44.16	
		Bheemarayana gudi	2	Boll formation	52.50		
		Gundhalli	2	Boll formation	41.00		
Chitradurga	Hiriyur	Shravanagere	2	Boll formation	27.00	22.50	28.25
		Yalnadu	2	Boll formation	18.00		
	Molakalmuru	Krishnarajapura	2	Flowering	32.00		

District	Taluk	Village	No. of fields visited	Stage of the crop	Disease incidence (%)	Mean disease incidence (%)	
						Taluk	District
		Kelaginakanive	2	Boll formation	36.00	34.00	

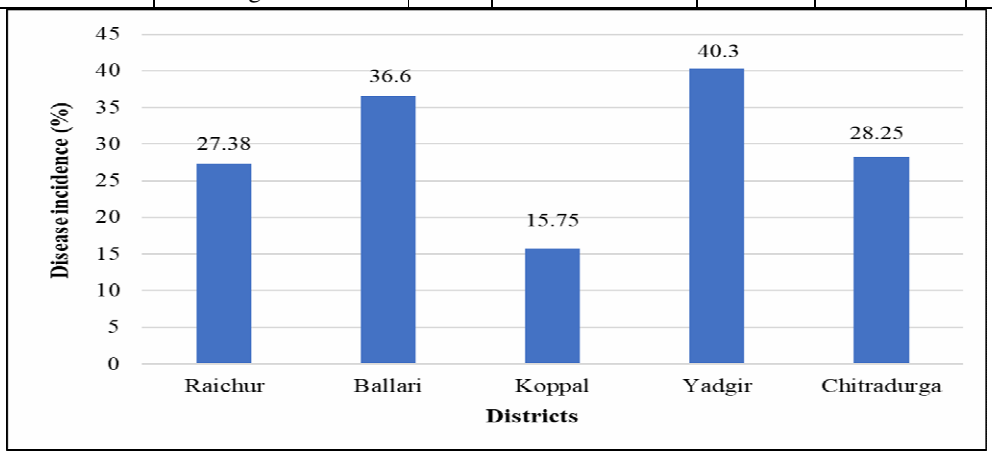
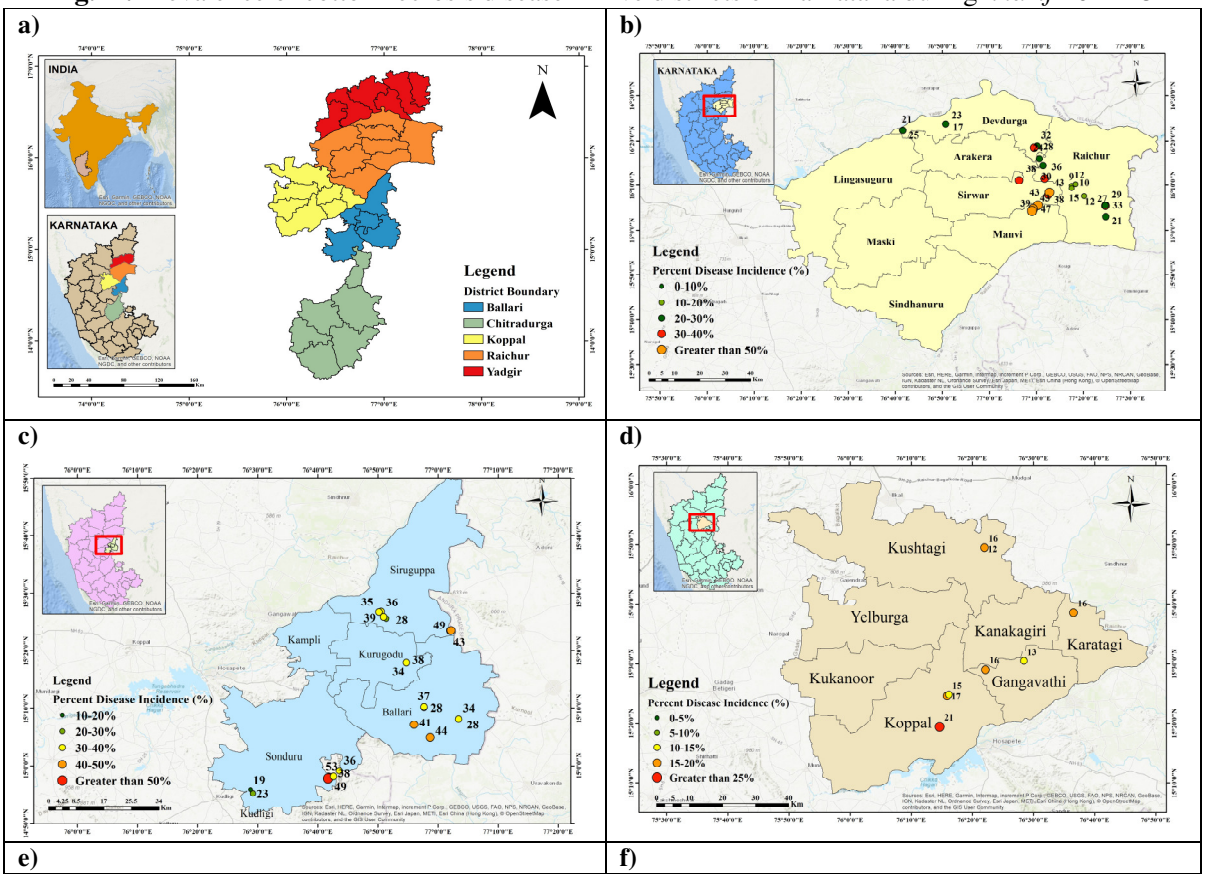


Fig. 1 : Prevalence of cotton necrosis disease in five districts of Karnataka during *kharif* 2024-25



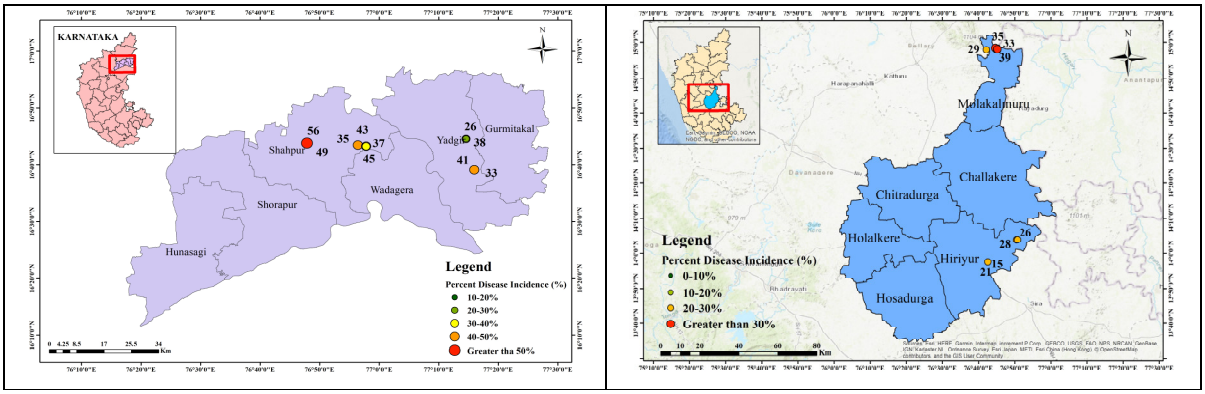


Fig. 2 : Distribution pattern of TSV infection in cotton across major cotton growing regions of Karnataka: (a) All Surveyed districts, (b) Raichur, (c) Ballari, (d) Koppal, (e) Yadgir and (f) Chitradurga.

Symptomatology

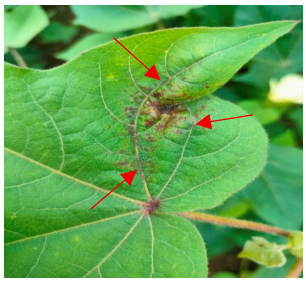
During the survey, the natural symptoms of cotton necrosis virus disease were carefully documented and presented here under. The initial symptoms appeared as chlorotic lesions, which gradually developed into necrotic, purplish brown spots on young growing leaves with faint mosaic. These spots varied in size and nature, ranging from small to large, and could present as either chlorotic or necrotic. A characteristic feature of the disease was the appearance of purplish brown spots surrounded by ring-like or irregular yellowish margins with faint mosaic, which served as prominent diagnostic signs. The spots often coalesced with prominent veinal necrosis, leading to extensive leaf drying. Under severe infection, the symptoms extended to the petiole and stem, resulting in stem necrosis, drying of floral squares, death of terminal buds, and ultimately stunted plant growth accompanied by extensive necrosis (Fig. 3).

Rageshwari *et al.* (2016) surveyed in Tamil Nadu, severe TSV incidence has been observed in cotton growing regions, particularly in Coimbatore and Erode districts. Initial symptoms appeared as chlorotic lesions turning into necrotic, purplish-brown spots with yellow margins, which later coalesced, causing leaf drying. Manjunath *et al.* (2023) observed severe infection led to petiole and stem necrosis, drying of squares and buds, and stunted plant growth. The observations on symptomatology in the present study are consistent with earlier reports, confirming the characteristic expression of tobacco streak virus induced necrosis in cotton.

Chlorotic lesions

Yellowing

Necrotic lesions



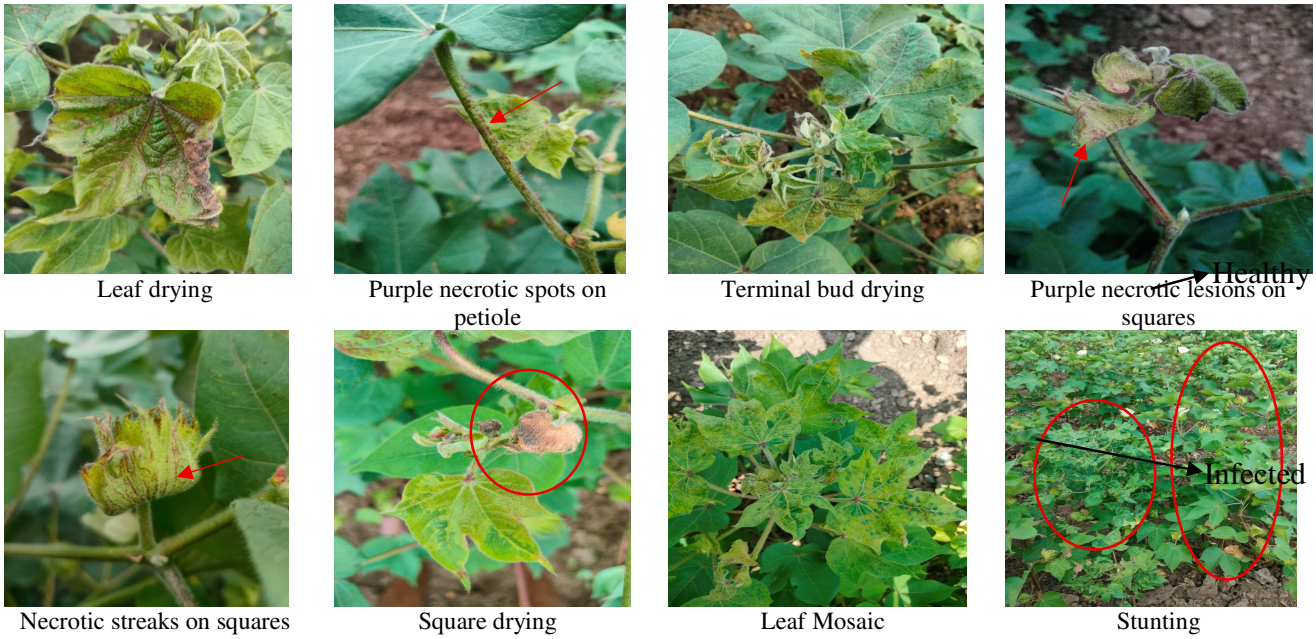
Veinal necrotic lesions

Purple necrotic spots

Initial leaf deformation

Leaf distortion

Blackening



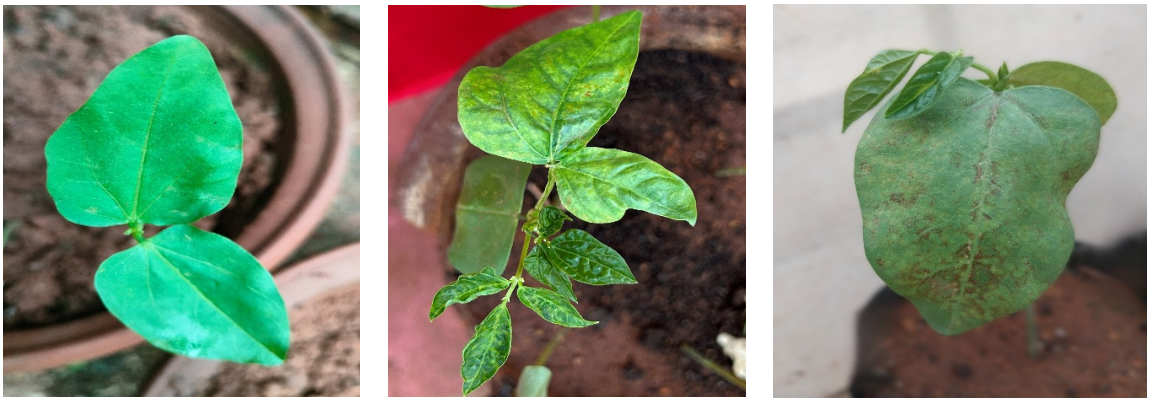
Leaf drying | Purple necrotic spots on petiole | Terminal bud drying | Purple necrotic lesions on squares

Necrotic streaks on squares | Square drying | Leaf Mosaic | Stunting

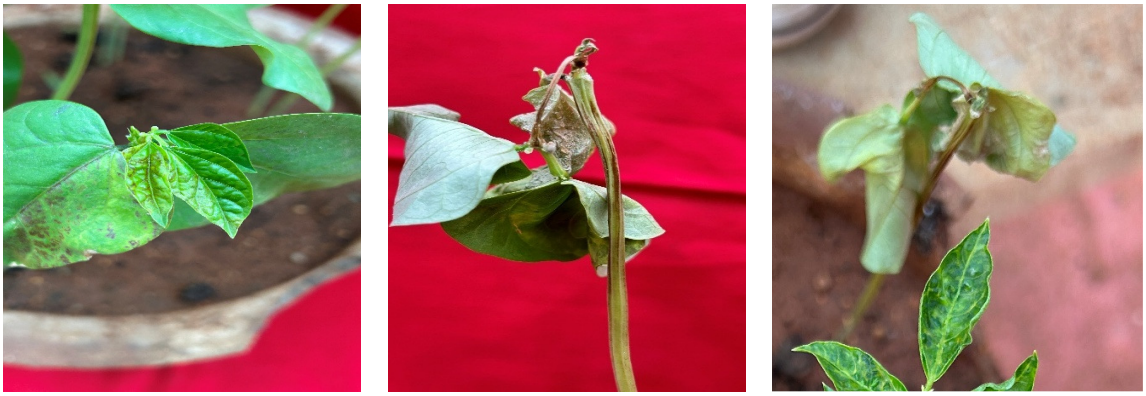
Fig. 3 : Characteristic symptoms of cotton necrosis disease under field condition

Mechanical transmission

Cotton leaf samples exhibiting characteristic necrosis symptoms were homogenized and mechanically inoculated onto two-leaf stage indicator host Cowpea (*cv*. 152). Within 3-4 days after inoculation, distinct chlorotic and necrotic lesions appeared on the inoculated leaves, followed by stem necrosis and eventually death of plant (Fig. 4), thereby confirming the association of the virus with necrosis disease in cotton. Previous reports also demonstrated successful sap inoculation of Tobacco streak virus (TSV) from sunflower, cotton, and black gram onto cowpea (*cv*. 152), which resulted in chlorotic lesions. These findings have documented TSV infections in several crop plants, including sunflower, groundnut, blackgram, and cowpea (Prasada Rao *et al.,* 2009; Ravi *et al.*, 2001; Bhat *et al*., 2002b; Vemana and Jain, 2010).



Healthy | Chlorotic lesions | Necrotic lesions



Necrotic lesions on emerging leaves | Stem necrosis | Death of Plant

Fig. 4 : Characteristic symptoms of necrosis disease on indicator host cowpea (*cv.* 152) under greenhouse condition

Summary

A field survey during *kharif* 2024-25 across five districts of North Eastern Karnataka revealed that tobacco streak virus (TSV)-induced cotton necrosis disease occurred with 9-56 per cent incidence, highest in RCH 659 BG II (Yadgir) and Kaveri (Ballari) hybrids. Typical symptoms included chlorotic and necrotic spots, veinal and stem necrosis, and stunted growth. Mechanical inoculation on cowpea confirmed TSV as the causal agent. The disease severity was influenced by cultivar susceptibility, thrips vectors, and alternate hosts. TSV is emerging as a serious threat to cotton, emphasizing the need for integrated management and resistant cultivars.

Conclusion

The study confirms the widespread occurrence of tobacco streak virus (TSV)-induced cotton necrosis disease in North Eastern Karnataka, with incidence ranging from 9 per cent to 56 per cent, influenced by cultivar susceptibility and the presence of alternate hosts that support thrips feeding and facilitate virus transmission. Field symptoms included chlorotic and necrotic leaf spots, veinal necrosis, leaf drying, stem necrosis, and stunted growth. Mechanical inoculation on cowpea (cv. 152) confirmed TSV as the causal agent. These findings highlight TSV as an emerging threat to cotton production, emphasizing the need for integrated management strategies, including field surveillance, vector control, removal of alternate hosts, and development of resistant cultivars.

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References

Bhat, A. I., Jain, R. K., Chaudhary, V., Reddy, M. K., Ramiah, M., Chattannavar, S. N. and Varmas, A. (2002b). Sequence conservation in the coat protein gene of Tobacco streak virus isolates causing necrosis disease in cotton, mung bean, sunflower and sun hemp in India.

Bhat, B. N. and Rao, S. C. (2014). Evaluation of sunflower germplasm/cultivars for resistance to sunflower necrosis disease. *Int. J. Plant Prot.,* **7**(1), 177-181.

Costa, A. S. (1945). The relationship between American tobacco streak and Brazilian "necrose branca" or "couve". *Phytopathology*, **35**, 1029-1030.

Fulton, R. W. (1948). Hosts of the tobacco streak virus. *Phytopathology*, **38**, 421-428.

Fulton, R. W. (1985). Tobacco streak virus. CMI/AAB descriptions of plant viruses no. 307. Association of Applied Biologists, Wellesbourne.

Jagtap, G. P., Jadhav, T. H. and Utpal, D. (2012). Occurrence, distribution and survey of Tobacco streak virus (TSV) of cotton. *Sci. J. Crop Sci.*, **1**(1), 16-19.

Johnson, J. (1936). Tobacco streak, a virus disease. *Phytopathol*., **26**, 285-292.

Manjunath H., Govindappa M.R., Aswathanarayana D.S., Palaiah P and Nidagundi, J.M. (2023). Epidemiology of necrosis virus disease caused by Tobacco streak virus in cotton. *Pharma Innov.,* **12**(12S), 369-373.

Prasada Rao, R. D. V. J., Reddy, A. S., Rao, S., Varaprasad, K. S., Thirumaladevi, K., Nagaraju, Muniyappa, V. and Reddy, D. V. R. (2000). Tobacco streak ilarvirus as causal agent of sunflower necrosis disease in India. *J. Oilseeds Res.,* **17**(2), 400-401.

Prasada Rao, R. D. V. J., Jyotsna, M. K., Reddy, A. S., Varaprasad, K. S., Nigam, S. N. and Lavakumar, P. (2009). Non systemic infection of Tobacco streak virus on

cotton in Warangal district, Andhra Pradesh. *Indian J. Plant Prot.,* **37**(1&2), 196-198.

Rageshwari, S., Renukadevi, P., Malathi, V. G. and Nakkeeran, S. (2016). Occurrence, biological and serological assay of Tobacco streak virus infecting cotton in Tamil Nadu. *J. Mycol. Plant Pathol.*, **46**(2), 159-168.

Rageshwari, S., Renukadevi, P., Malathi, V. G., Amalabalu, P. and Nakkeeran, S. (2017). DAC-ELISA and RT-PCR based confirmation of systemic and latent infection by Tobacco streak virus in cotton and *Parthenium*. *J. Plant Pathol.*, **99**(1), 469-475.

Ravi, K. S., Buttgereitt, A., Kitkaru, A. S. and Deshmukh, S. (2001). Sunflower necrosis disease from India is caused by an Ilarvirus related to Tobacco streak virus. New Dis. Rep., **3**, 10.

Reddy, A. S., Rao, R. P., Thirumaladevi, K., Reddy, S. V., Mayo, M. A., Roberts, I., Satyanarayana, T., Subramaniam, K. and Reddy, D. V. R. (2002). Occurrence of Tobacco streak virus on peanut (*Arachis hypogaea*) in India. *Plant Dis.*, **86**(2), 173-178.

Sharman, M., Persley, D. M. and Thomas, J. E. (2009). Distribution in Australia and seed transmission of Tobacco streak virus in *Parthenium hysterophorus*. *Plant Dis*., **93**(7), 708-712.

Vemana, K. and Jain, R. K. (2010). New experimental hosts of Tobacco streak virus and absence of true seed transmission in leguminous hosts. *Indian J. Virol.,* **21**, 117- 127.

Vinodkumar, S., Nakkeeran, S., Malathi, V. G., Karthikeyan, G., Amala Balu, P., Mohankumar, S. and Renukadevi, P. (2017). Tobacco streak virus, an emerging threat to cotton cultivation in India. *Phytoparasitica*., **45**(5), 729-743.