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Viral disease outbreak and diagnosis in chickpea (*Cicer arietinum* L.) under Tamil Nadu: A new report

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Abstract

Chickpea (*Cicer arietinum* L.) is an important legume crop in the world. In global wide, it was cultivated during rabi season (Nov-Feb). Under India, it was cultivated during cool winter season mostly depending upon rainfall and dew distribution. In Tamil Nadu, mostly north – western districts are considered as chickpea belt. Regularly crop period, wilt or root rot diseases are highly prevalent and drastically reduced yield. Since, Rabi (2017-18) a new disease was occurred and reported that causing yield loss (40-60%) from vegetative to podding stage by failure of seed formation on mostly in Coimbatore and Tirupur districts. Under extensive survey, a viral outbreak of incidence occurred due to chlorotic stunt disease, maximum recorded in Poolankinar (28.6%) on cv. CO 4 and the least incidence has been recorded in Kuppuchipalayam (12.9%) on cv. JAKI-9218 at age of 65 days old crop. Based on symptomatic diagnosis viz., chlorosis, reddening of leaf petioles, shortening internodes, bushy appearance was characterized initial stages and later failure attained in blooming and pod formation. This disease was the most prevalent in North India. Perusal of literature showed that the occurrence of this disease in Tamil Nadu seems to be new. Hence, this may be a new report based on the visual diagnosis.

Keywords: Chickpea, chlorotic stunt, leaf hopper, *O. albicinctus*, yield loss

Introduction

Chickpea (*Cicer arietinum* L.) is one of the major cool winter pulse crop in global wide (Merga and Haji, 2019) ^[1]. It's especially cultivated for their nutritional availability and easily digestible fibres for children's diet (Wallece *et al.*, 2016) ^[2]. Under worldwide, chickpea was cultivated in arid and semi-arid regions on (Rabi) rainfed conditions during November onwards (Thaware *et al.*, 2015) ^[3]. In globally, India accounts for 75% of world's chickpea production on 13.98 million ha area with production 137.3 lakh tonnes and productivity 982 kg/ha which represents 40 to 68.0% and 48.1% of the national pulse acreage and production (Kumari and Khanna, 2018) ^[4]. In Tamil Nadu, chickpea was cultivated in an area of 6820 hectares with a production of 4177 tonnes and a productivity of 645 Kg / ha. There are four major districts where cultivated in Tamil Nadu viz., Tirupur (2441 ha), Dharmapuri (2110 ha), Coimbatore (892 ha) and Dindigul (537 ha) with two types of chickpeas were cultivated viz., desi and kabuli (Murali Sankar *et al.*, 2018) ^[5].

In past triennial periods, chickpea cultivation and production has been drastically reduced due to several factors like biotic (pest and diseases) and abiotic factors viz., insufficient rainfall, relative humidity, rapid increasing of atmospheric temperature, changes in soil nutritional status and unavailability of climatic-optimal cultivars (Liberato *et al.*, 2018) ^[6]. Especially, the pathogens and their causing diseases are most influenced the yield loss from seedling to harvesting stages through self-recaption ability and rapid changing of virulence nature (Jimenez-Diaz *et al.*, 2015) ^[7]. Regularly, chickpea was noticed that more than thirty diseases by fungal, bacterial, viral and nematodes also (Nene *et al.*, 1996) ^[8]. Especially, viral diseases are play as a major constraint in chickpea yield before flowering to pod setting stages (Abraham and Makkouk, 2002) ^[9]. Approximately, 14 virus species have been reported in cool legume crops (Kumari *et al.*, 2004) ^[10].

Among the 14 species chlorotic stunt disease (CSD) is an important catastrophic endemic disease in India (Horn *et al.*, 1995) [11] and causing severe yield loss on crop stages *viz.*, before flowering (100%) and flowering to pod maturation (75-100%) (Reddy and Kumar, 2004) [12]. It was caused by chickpea chlorotic dwarf virus (CpCDV) (genus: Mastrevirus; family: Geminiviridae) and infects several plant families *viz.*, Fabaceae, Cucurbitaceae and Solanaceae (Kanakala and Kuria, 2019) [13]. It has been transmitted through leafhopper *O. albicinctus* (Syria) and *O. orientalis* (India) (Makkouk *et al.*, 2012; Zerbini *et al.*, 2017) [14,15].

Generally, it occurred during ramification to flowering stage, it has been easily identified and diagnosed by their typical symptoms *viz.*, chlorotic, yellowing, internode shortening, bushy appearances of leaves, leaves turning yellowish (Kabuli) while leaf reddening, phloem vessels were browning in collar region (Desi) (Kraberger *et al.*, 2015) [16]. The infected plants become stunted, non-flowering, if except go to podding – shrinkled small and unmatured seeds are formed

(Shahmohammadi *et al.*, 2020) [17]. Keep these views, an extensive survey and diagnosis was carried out for prevalence of chlorotic stunt incidence and diagnosed under field conditions on chickpea growing areas of Tamil Nadu.

Material and Methods

Survey and assessment of incidence

An extensive survey was conducted in major chickpea growing areas in districts of Coimbatore and Tirupur districts in Tamil Nadu during Rabi, 2017-18. In each district major chickpea cultivated villages were selected for a view to assess the chlorotic stunt incidence. Three fields were selected and in each farmers field 0.1 ha area was selected at random. Total and infected plants were counted in all the selected areas and the wilt incidence was calculated by using the following formula described by Noo *et al.* (2016) [18].

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

Table 1: The name of the villages surveyed along with districts surveyed one furnished below in the

S. No.	Districts	Survey conducted villages	Geo-informatics			Varieties	Age of the crop (Days)
			Latitude (°N)	Longitude (°E)	MSL (m)		
1.	Coimbatore	Idigarai	11.11	76.96	431	CO 4	66
2.		Athipalayam	11.12	76.98	440	CO 4	60
3.		Periyanakanpalayam	11.14	76.94	440	CO 4	70
4.		Kuppuchipalayam	11.02	77.39	305	CO 4 & JAKI - 9218	72 & 65
5.	Tirupur	Poolankinar	10.59	77.19	375	CO 4	65
6.		Kanakkampalayam	10.57	77.22	375	CO 4	70
7.		R. Velur	10.55	77.19	375	Local	58

Diagnosis

In field conditions, based on symptomatic descriptions by (Makkouk *et al.*, 2003) [19] the infected plants were examined through growth transformations *viz.*, plant height, changing of internodes growth, transformation of leaf petioles, colouration of leaves and collar pith portion and plant age also observed visually.

Results and Discussion

Survey and assessment of incidence

Under survey conducted in major chickpea growing areas of

Tamil Nadu during Rabi, 2017-18; chlorotic stunt incidence was significantly observed in all chickpea growing areas at 12.9 to 28.6%, among them, the maximum incidence was recorded in Poolankinar (28.6%) on cv. CO 4 within age of 65 days of crop. The least incidence has been recorded in Kuppuchipalayam (12.9%) on cv. JAKI-9218 at age of 65 days old (Table 1, Figure 1). These results were coincided with a great outbreak of chlorotic stunt in major states *viz.*, Andhra Pradesh, Maharashtra, Uttar Pradesh, Rajasthan in India during 2012 and 2015 in Tunisia noted by Kanakala *et al.* (2012) and Kumari *et al.* (2015) [20, 21].

Table 1: Survey and occurrence of chlorotic stunt disease in major chickpea growing areas of Tamil Nadu during 2017-18.

S. No.	Districts	Survey conducted villages	Varieties	Age of the crop (Days)	Per cent disease incidence (%)
1.	Coimbatore	Idigarai	CO 4	66	23.2 ^d
2.		Athipalayam	CO 4	60	28.2 ^b
3.		Periyanakanpalayam	CO 4	70	22.7 ^e
4.		Kuppuchipalayam	CO 4 JAKI - 9218	72 65	24.3 ^c 12.9 ^f
5.	Tirupur	Poolankinar	CO 4	65	28.6 ^a
6.		Kanakkampalayam	CO 4	70	24.6 ^c
7.		R. Velur	Local	58	23.1 ^d
SEd					0.99
CD (P=0.05)					0.441

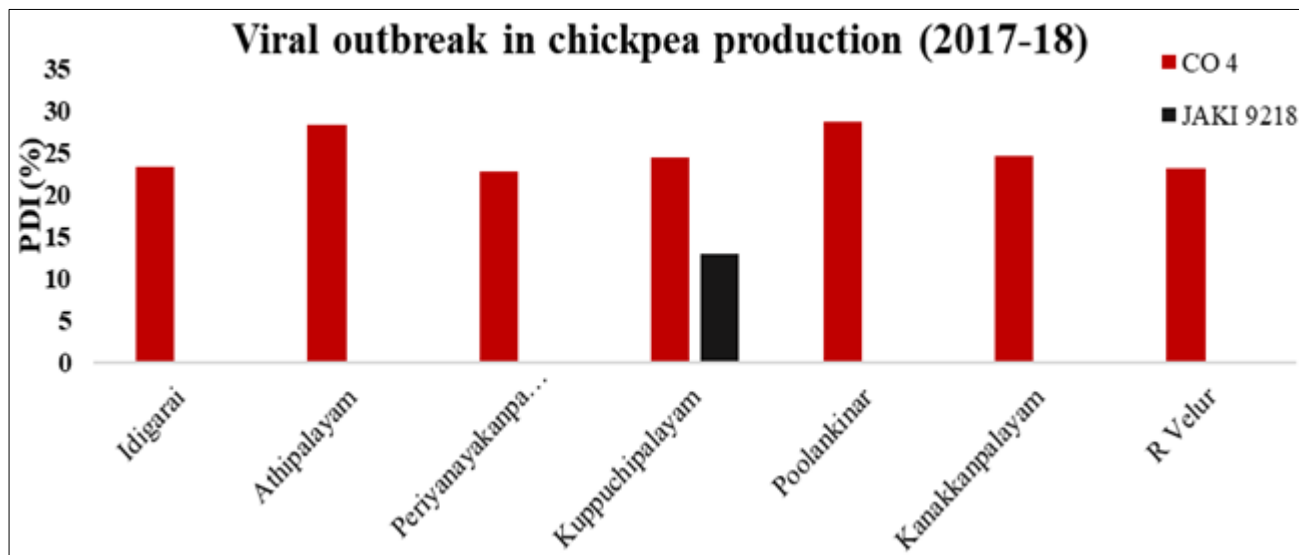


Fig 1: Viral outbreak (Chlorotic stunt) in major chickpea growing areas of Tamil Nadu (2017-18)

Diagnosis

In field conditions, symptoms are in random conditions on whole field. The infected plants are chlorosis, yellowing, pointed numerous leaf petioles, shortening of internodes, leaf marginal reddening (Desi) and collar portion of plant also

reddening and busy appearance was observed without flowering (Figure 2). These results were noted and similarly with descriptions of Abraham *et al.* (2006) and Horn *et al.* (1996) [22, 23].

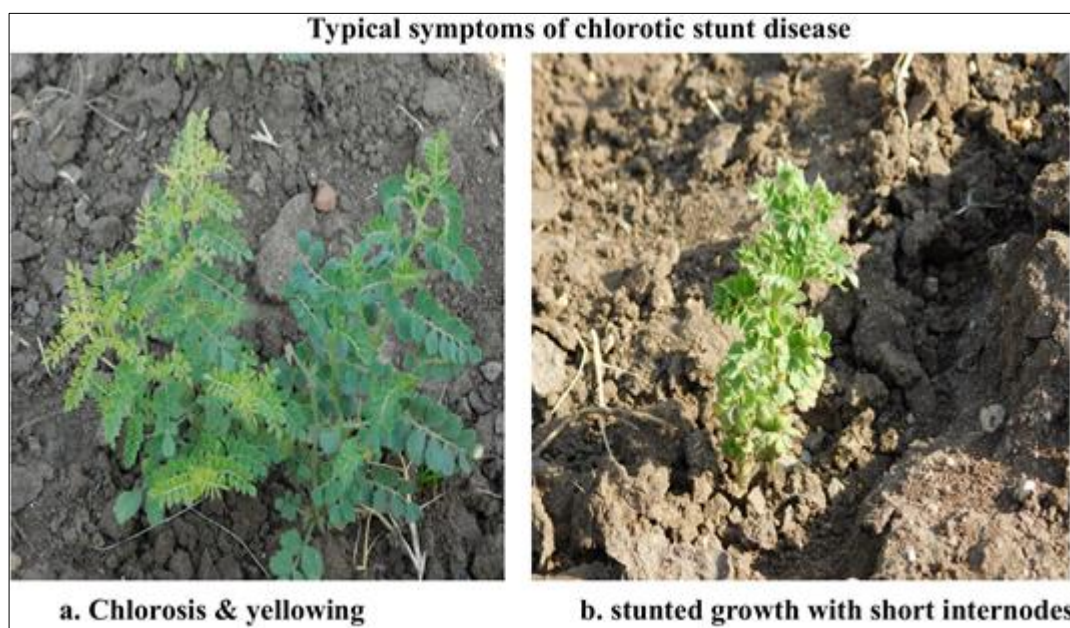


Fig 2: Diagnosis of chlorotic stunt disease in chickpea (*Cicer arietinum* L.) under field conditions

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