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Managing Rust Disease

in chickpea in transitional tract of Karnataka

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The productivity of chickpea in Karnataka is very low (629 kg/ha), the main reasons being susceptibility of chickpea cultivars to biotic and abiotic stresses which reduces yield and yield stability. Moreover environmental conditions in this region are favourable to the pathogen. More than 50 pathogens have been reported to affect chickpea which includes both soil and air borne pathogens. Most of the research efforts so far were made in developing resistance to soil borne fungal pathogens and the foliar fungal diseases which are of least importance, as they do not bring much yield loss. But in the recent past chickpea rust is becoming major threat to chickpea cultivation, particularly in transitional tract of Karnataka.

CHICKPEA (*Cicer arietinum* L.) is one of the ancient food legume cultivated by humans. It is an extremely important pulse crop in semi-arid areas of central, south and south-east Asia. In India, chickpea is the most important pulse crop contributing to over 40% of country's total pulse production. However the area under this crop has been decreasing in the traditional areas of north and north western India. On the other hand the area under chickpea in central and peninsular India is increasing. Karnataka is a major state in peninsular India with 9.6 lakh hectare area under chickpea cultivation and production of 6 lakh tonnes.

Chickpea rust and its importance

Among the foliar diseases, chickpea rust is caused by *Uromyces ciceriarietini*. It was considered as a minor disease as it appears late in the season when the crop is maturing and hitherto, it was never noticed in epiphytotic scale in India, particularly in Peninsular region.

Hence, no serious research efforts were made to develop rust resistance varieties in chickpea. The disease is widespread elsewhere-in the Mediterranean, south-east Europe, south Asia, east Africa and Mexico, but is usually considered to be of only local importance. It has been reported as a significant problem affecting chickpea production in central Mexico and Italy. It was reported for the first time in Mexico during 1961, and the United States in 1985. In both the countries the spread of the disease was very fast and almost all the cultivars were susceptible. In Karnataka the chickpea rust epidemic was reported for the first time during the year 1987. It has not received much attention so far, as it appears late in the season when the crop is maturing. It has caused significant yield losses in chickpea growing transitional tract of Karnataka during *rabi* 2008-09 and 2009-10. The severity of disease is very high causing 80 to 100 percent yield loss. However during *rabi* 2010-2011, disease was observed in few late sown areas only.

Symptoms

The chickpea rust disease is first seen as small round or oval, light brown to dark brown pustules on both the surfaces of foliage. Such lesions appeared in large numbers on lower surface. In advanced stages, the sori is also seen on upper surface of leaf, pods and occasionally on stem. In majority of the cases the individual sori covered the entire leaflet and measured from 1-5 × 1-3 mm. These sori gave a brick red colour to the infected plants which could be identified from a distance.

Morphology of the pathogen

Uromyces ciceri-arietini is a hemiform, the pycnial and the aecial stages being unknown. The uredia are as a rule hypophyllous and scattered, minute, round, pulverulent, when

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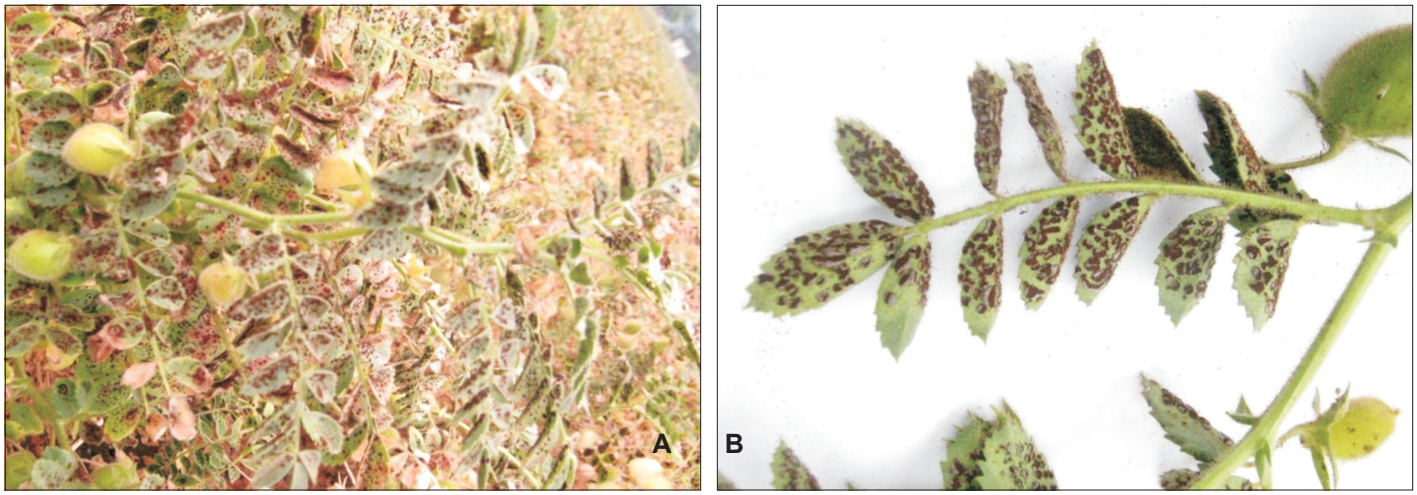

Chickpea rust (a) Crop view (b) Leaflet rust pustules on lower surface of leaf

mature and cinnamon-coloured. The urediospores are globose to subglobose, loosely echinulate, 20 × 28 μ in diameter, yellowish-brown with a rather thick epispore and four to eight germ pores. The telia resemble the uredia but are darker brown; the teliospores are variable in shape, round, ovate or angular with a roundish, unthickened apex and brown, warty or roughened wall. They measure 18 to 30μ by 18 to 24μ and have a short, hyaline pedicel from which the teliospores get readily detached. They have a single germ pore, and their somewhat deeper coloured epispore distinguishes them from urediospores.

Viability and germination of uredospore

Temperature is the key factor for both viability and germination of uredospore. The uredospres remain viable for 48 weeks when stored at 6-7°C but are killed within two weeks if exposed to 30-35°C. Fresh spores can be germinated in tap water at 18°C. At this temperature germination commences in 2.5 hours. However, these spores lose their viability and germinates even on host plant at temperature above 35°C.

Resistance source

All the presently grown cultivars are highly susceptible to the disease. No source of resistance to rust have been identified and so far only measures relating to sowing dates and chemical control have been proposed. One of the reasons for absence of variability may be its monophyletic descendence from *Cicer reticulatum*. Only a certain degree of slow-rusting has been reported and it tends to be more frequent in wild *Cicer* relatives. Chickpea germplasm line RIL58-ILC72/Cr5 is reported as moderately resistant to rust disease.

Breeding approaches

Absence of resistance to the disease in the cultivated varieties is a major challenge to the plant breeder. Screening of chickpea germplasm along with wild species under epiphytotic condition may result in identification of resistant genotype. A moderately rust resistant germplasm line RIL58-ILC72/Cr5 could be used in breeding programme. In addition, there is a need to create variability for rust resistance in chickpea. Efficient tool to create new genetic variability in autogamous and narrow genetic base crops like chickpea is mutagenesis. Induced mutations and mutation breeding techniques for food legumes in general and chickpea in specific have been successfully applied. Till date more than 400 mutant varieties have been successfully released worldwide. The genetic variability for several desired characters was created successfully through induced mutations. Some of the varieties released for commercial cultivation have also shown tolerance to biotic stresses. Chickpea mutant varieties, Pusa 408, Pusa 413, Pusa 417 and WCG-2 released for commercial cultivation were resistant to soil borne fungal pathogens. Hence mutagenesis could be used as important breeding tool to develop rust resistance in chickpea.

SUMMARY

Chickpea rust caused by *Uromyces ciceri-arietini* has not received much attention so far, as it appears late in the season when the crop is maturing. It has caused significant yield losses in chickpea growing in transitional tract of Karnataka in the previous 2-3 years. The disease first evidenced as small round or oval, light brown to dark brown pustules on both surfaces of foliage and in advanced stage gives brick red colour to whole plant, which could be identified from distance. Temperature is the key factor for both viability and germination of uredospore. There is no report of resistance source in cultivated species. Evaluation of wild relatives and creation of variability is essential.