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**ABSTRACT**

Chickpea lacks cold tolerance and is sensitive to chilling temperatures (>8°C), especially at its reproductive phase (Srinivasan *et al.,* 1998; Bakht *et al.,* 2006). The reproductive structures can with stand temperature of 8°C minimum to 22°C maximum during the coldest period. In the present investigation the effects of cold stress on morpho-physiological traits in chickpea genotypes were studied at reproductive stage. Pot experiment was conducted simultaneously in the control and treated conditions respectively at Division of Plant Physiology, Chatha, and field trials were conducted in October, 2020-2022 at ACRA, Dhiansar, SKUAST, Jammu. Pot experiment was exposed with low temperature below the threshold temperature (less than 8oC) at reproductive stage. Sampling was done above threshold temperature (>8oC) was taken as control in pot experiment and destructive sampling was done after the plants experiencing temperature lower than threshold point i.e., less than <8oC during flowering stage. The pot experiment and field trials were examined in a factorial design of experiment form in a randomized completely block design with three replications. The factors to be studied 32 chickpea genotypes and cold stress at flowering stage. Cold stress induced changes in physiological traits viz. for plant water status *i.e.* relative water content (RWC %), relative stress injury (RSI %), total chlorophyll, biochemical i.e. total soluble carbohydrate (TSCs), proline accumulation, and antioxidant enzymes were studied and reproductive changes, yield and yield attributing characters were studies at harvesting stage.Molecular characterization was also done by using SSR markers.

The results showed that cold stress induced at flowering stage declined the RWC% of leaf in stress condition ICCV 88506 genotype (89% to 72%) followed by Pusa 362 (88% to 71%) and ICCV 92944 (87% to 70%) and other chickpea genotypes were at par whereas RSG 896 (82% to 58%) and PBG 5 (81% to 56%) were performed minimum. TSCs (10.49 to 38.0 mg g-1FW) and proline content (6.07 to 17.88 µmoles/g FW) increased in all genotypes during cold stress condition in pot as well as in field condition. Cold stress induced the specific activity of antioxidant enzymes such as superoxide dismutase (SOD) peroxidase (POX) and catalase (CAT). Morphological parameters such total seed yield per plant also decreases during cold stress in pot experiment followed by field condition and maximum was found in ICCV 88506 followed by Pusa 362 and ICCV 92944. Cold stress increased the activity of antioxidants superoxide dismutase and peroxidase in chickpeagenotypes, and it was observed that the genotypes that have higher yields under drought stress had higher levels of enzyme activity. Molecular studies such as PIC value, number of alleles per locus and polymorphism percentage were studied for three SSR markers.

The results of this study suggest that cold stress greatly influences yield components and physiological functions that affect plant growth and yield production in chickpea genotypes. This effect is highly dependent on cold stress intensity. Although chlorophyll content might act as part of a survival mechanism under stress conditions however, stronger relationship was found between cold tolerance and chlorophyll content under severe stress condition. Results of all physiological and biochemical traits indicated that chickpea genotypes ICCV 88506 followed by Pusa 362 and ICCV 92944 were more tolerant to cold stress condition and can be used in breeding programme for developing cold tolerance chickpea genotypes.

**Key words:** *Chickpea*; *plant water status; proline; antioxidant enzymes; SSR markers*