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Induction systemic resistance in cowpea against Macrophomina phaseolina that causes charcoal rot disease using chemical inducers

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Abstract

Charcoal rot disease caused by Macrophomina phaseolina on cowpea results in yield losses with serious socioeconomic implication. Sixteen isolates of M. phaseolina were isolated from cowpea diseased plants collected from different locations in New Valley Governorate. All obtained isolates able to attack cowpea plants (cv. Balady) causing charcoal rot on the basil stem with various degrees of diseases severity. M. phaseolina isolate No. 14 was the most aggressive ones in this respect causing 85.8% charcoal rot.

Potassium silicate (KS), propyl gallate (PG), hydroquinone (HQ) and salicylic acid (SA) at 1,5 and 10 mM were used in this investigation as promising methods for controlling such diseases in vitro and in vivo. Results illustrated that all tested chemical inducers were little effect on growth of M. phaseolina at different concentrations in vitro. The inhibition growth of M. phaseolina was slightly increased by increasing of chemical inducers concentrations. Under greenhouse and field conditions, all tested chemical inducers significantly decreased charcoal rot compared to the check treatment (control). Propyl gallate and HQ resulted the lowest charcoal rot severity. On contrary, SA and KS recorded the lowest protection against charcoal rot severity

Also, all tested chemical inducers significantly improvement cowpea plant growth parameters viz. plant length, No. of branches/plant, fresh and dry weight of plants (kg/feddan) and yield components viz. pod length (cm), No. of seed pod-1, weight of 100 seeds, total seed yield (Kg fed.-1) compared with control during seasons 2014-2015 and 2005-2016. Cow pea seeds soaked in PG at 5 mM recorded the highest yield components in both seasons. While, HQ recorded the lowest ones. Analysis of plant mineral compositions showed a significant increase in contents of nitrogen (N), potassium (K), phosphorus (P), and crude protein in cowpea plants grown from cowpea seeds treated with any chemical inducers compared with control plants during growing seasons (2014-2015 and 2015-2016). Salicylic acid followed by PG gave the height mineral contents in both growing seasons.

Accumulation of ascorbate peroxidase (APO), polyphenol oxidase (PPO), phenylalanine ammonia lyase (PAL), superoxide dismutase (SOD) enzymes, pathogenesis related (PR) protein (chitinase an β-1,3- glucanase), phenolic, flavonoids and lignin contents in plants inoculated with M. phaseolina treated with chemical inducers were increased compared with untreated inoculated and untreated un-inoculated plants. PG recorded the highest levels of oxidative enzymes, pathogenesis related (PR) protein and phenol, flavonoid, lignin contents during all tested periods of determination. In general, enzymes activities of APO, PPO, and β- 1,3- gluconase begin to accumulate after two days of treatment and reached maximum levels at 8 th days while, PAL, SOD, chitinase reached maximum levels at 6th days then the activities of these enzymes were decreased progressively. On the other hand, total phenols, flolvoniads and lignin increased in cowpea plants inoculated with M. phaseolina and treated with tested inducers. The highest accumulation of phenols was recorded 6th days from application, while flavonoids and lignin recorded the highest level at 8th days from application. These results suggested that these chemicals may be play an important role in controlling the cowpea charcoal rot disease, through they have induction of systemic resistance in cowpea plants.

Biography:

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Speaker Publications:

1. ABDEL-AZIZ T.K., HAMED N.M., ABOEL-GOUD S.H.A., 2008. Response of cowpea to application of K and farmyard manure under New Valley conditions. J Agric Sci Mansoura Univ.; 33 (3):1675-1690

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