Biochemical screening of ten peanut cultivars for tolerance to *Botrytis cinerea*

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Abstract

Botrytis cinerea Pers. *ex* Fr. (Ascomycota), the causal agent of Botrytis blight disease, is one of the main yield reducing reasons for peanut cultivation worldwide. Due to the amiable growth conditions for this fungus, the pervasiveness of the disease is alarming in India. In the present investigation, through *in vitro* inclusion of purified fungal isolates to build up disease incidence, ten commonly grown cultivars *viz.* GG20, GG7, J11, M13, Somnath, Gangapuri, BAU13, RJ382, RJ510, and RJ578 of peanut (*Arachis hypogaea* L.) were screened for their morphological and biochemical parameters. To get all inclusive response, the optimum growth conditions were provided throughout the experiment. The selected growth parameters for this study were length of root and shoot, shoot moisture, shoot inhibition, fresh and dry weight and leaf area that were used to screen out tolerant and susceptible cultivars. It was found that among the ten selected cultivars of *A. hypogaea*, cultivar RJ510 exhibited the best opposing response while RJ382 was the most affected cultivar against the pathogen attack. A dynamic correlation was attained regarding certain growth and biochemical factors towards the resistant abilities of cultivars in response to fungal invasion. The results showed a definite order of tolerance, i.e. RJ510 > RJ578 > GG20 > Gangapuri > Somnath > J11 > BAU13 > M13 > GG7 > RJ382, among the infected cultivars of Peanut. Hence, the study reveals RJ510 as the best suited cultivar to be grown in *Botrytis cinerea* affected regions of India and elsewhere.
Keywords- *Arachis hypogaea*, *Botrytis cinerea*, Chlorophyll, Polyphenol, Proline, Protein.

Introduction

Peanut or groundnut is a yearly crop plant in the family Fabaceae. It is believed that it was originated and domesticated in America (south and central) about 3,500 years ago, which is now cultivated in warm-temperate and tropical regions of the world for its economically important seeds. China is the leading producer of this crop which is followed India, Nigeria, USA, Senegal, and Myanmar. According to an estimate, the worldwide commercial production of peanuts is about 37.6 million metric tons. This crop was also promoted as an alternative crop to cotton, which usually shows a decline in productivity due to soil depletion and pest damage. Apart from oil yield, more than 150 different products are made from peanuts worldwide. In India, states namely Gujarat, Andhra Pradesh, Telangana, Tamil Nadu and Karnataka have irrigated areas with peanut as rabi crop (Madhusudhana, 2013).

Like other economically important crops, peanut is always exposed to a range of biotic and abiotic stresses that lead to great yield loss. Soil-borne fungal pathogens usually considered as the most notorious among all stresses that cause extreme productivity loss. Once the plants get infection, they show several physiological disorders and structure deviations that ultimately result into significant decrease in the estimated total yields (Chakraborty *et al*., 2015). Botrytis blight, caused by *B. cinerea* exhibits adverse effects on the seed quality by causing reduction in seed size and discolouration (Ren *et al*., 2016). The causal agent, *B. cinerea* is a necrotropic fungus also known as gray mold or *Botrytis* blight infects aerial parts of the plant during the favourable (cool and moist) climatic conditions. The expression of the gray mould symptoms become most pronounced during warm period as a result of rapid growth of fungus (Williamson *et al*., 2007).

India has been cultivating groundnut since long time and with the production of 5.9 million tons, currently ranks second among the leading producers in the world (Misra, 2017). In agricultural fields of India, *B. cinerea* survives the unfavourable time either as chlamydospores in the soil or as mycelia on the vegetative parts of the plant (Lakshmi *et al*., 2011). Depending upon the severity, this disease may causes up to 100% yield loss (Chakraborty *et al*., 2015). To counter this fungus, traditionally fungicides are being used by the farmers as the simplest strategy. However, with day to day increasing threat regarding these hazardous substances, focus has been shifted towards the sowing of resistant cultivars in fungal prone fields because these cultivars when exposed to this biotic stress start to accumulate an array of metabolites, particularly amino acids as defense molecules. Resistant cultivars are also capable of developing phenolic compounds as phytoalexins (Sobolev *et al*., 2006). In case of Peanuts, stillbenoids have been considered as the major sustaining factor in plant defense mechanism (Rao *et al*., 1994). Phenolic compounds are related to oxidative enzymes and are mostly considered as one of the important biochemical parameters in disease resistance. The type and concentration of metabolites during stress is also one of the major factors to differentiate resistant and susceptible genotypes, which is remarkably helpful in selection of the genotypes biochemically. Therefore, biochemical screening of genotypes is presumed to provide a better picture regarding the resistance capabilities of plant against pathogen. Keeping this in view, in the present study, 10 cultivars of *A. hypogaea* were biochemically screened against the fungus *B. cinerea.*

Materials and Methods

Fungal strain and its activation

The pure strain procured from Institute of Microbial Technology, Chandigarh of *Botrytis cinerea* (MTCC 369) is used for this work. Activation of lyophilized fungal strain was done by inoculating it in 250 mL flask containing potato dextrose broth (PDB) at the rate of 24 g L^{-1} concentration. Condition was made aseptic in a Laminar Air Flow hood. Incubation was done on incubator shaker at a temperature of 27±2 °C with shaking at 100 rpm for 7 days. Subsequently, activated fungus was then streaked on media slant. Slants were incubated for 6 days at 27±3 °C. After incubation the growth of mycelium was initiated for inoculum.

Preparation of inoculum

Preparation of inoculum was done under aseptic conditions of laminar flow hood. The mycelium surface mat was scrapped gently for 3-4 times by a sterilized loop for inoculation of conical flask containing autoclaved distilled water. Subsequently, the conical flasks were placed in the shaker incubator (27±2 °C, 100 rpm) for 3 hours. The counting of spores was done under the microscope by haemocytometer, and then the concentration was kept up at 10^5 mycelia mL^{-1}.

Plant growth and inoculation

The selected cultivars of *A. hypogaea viz*., GG20, GG7, J11, M13, Somnath, Gangapuri, BAU13, RJ382, RJ510 and RJ 578 were obtained from Directorate of Groundnut Research Junagarh, Gujarat and Rajasthan Agriculture Research Institute Durgapura, Jaipur, India. The seeds were made germ-free with 0.1% $HgCl_2$ (w/v) for 10 min and followed by repeated washing with double distilled water. Seeds germination was desorbed and blotted onto moist thick paper in Petri dishes at 24 °C for overnight dark condition. Plastic pots containing 200 g soilrite and four seeds were sown in each pot. The plants were grown under controlled conditions in growth chamber at 16 h photoperiod, a photon density of 160 µ mol quanta m^{-2} s^{-1} and a relative humidity between 55-60 % at 20±18 °C, having 1.5 kg sterilized soil and soilrite (Keltech Private Ltd, Udaipur, India) in a ratio of (3:1) in a growth chamber under a 16h/8h day/night photoperiod 220±20 µE/m^2/s, temperature 24 °C / 25 °C (Kumari *et al*., 2015). The biochemical traits on 21days old plants of the *A. hypogaea* cultivars RJ510 and RJ382 were used as they were observed as the most tolerant and susceptible cultivars, respectively, after a critical screening via growth parameters. The samples were tested post inoculation with *B. cinerea* on 5^{th}, 10^{th}, 15^{th}, 20^{th}, 25^{th} and 30^{th} day.

Growth analysis

On day zero, seeds were inoculated. From each set of plants, four seedlings with their roots were randomly collected. The parameters related to growth, such as shoot and root lengths, dry and fresh weights and area of leaf lamina were measured at 5^{th}, 10^{th}, 15^{th}, 20^{th}, 25^{th}, and 30^{th} day, after *Botrytis* treatment. Soil particles were removed from the plants by running tap water. Plant roots were separated from the shoot and the length of every shoot and root was recorded by using a meter scale. The dry weight of shoot and root samples was observed after drying the samples in the oven at 80 °C for 48 h. Leaf area was determined with the help of graph paper.

Index of disease severity

Calculation of the disease severity index was done with a slightly modified method of (Bhattacharyya *et al*., 1985). The level of infection caused by *B. cinerea* was indicated by the incidence of dark yellow to dark brown lesions, and also by the occurrence of fungal mycelia on the root, shoots and leaves. The vigorous and infected plants were classified into following 4 groups:

Fresh plants 0 = no symptoms of blight and wilt

Faintly damaged plants 2 = dark yellow and dark brown spot on apical parts as well as on the geotropic primary roots.

Highly diseased plants 2 = weak and stunted plants with rotted roots. Dead plants 4 = dead and fallen plants

Lesions on the whole leaf and root system along with the disease severity index was calculated by following formula:

$$DI = \frac{0(H^n)+2\,(S^n)+2\,(H^n)+\,4(D^n)}{\text{Total number of tested plant}}$$

Where,

(H^n)- {number of vigorous plants}

(S^n)- {number of slightly infected plants}

(H^n)- {number of seriously infected plants}

(D^n)- {number of deceased plants}

Leaf area

The leaf area was calculated in cm^2 according to Nain *et al*. (2012). The fresh leaves were collected, placed on A4 size sheet, their outline was drawn carefully. The outlined area was cut and weighed. Likewise, another A4 size paper was taken and its area and weight was measured. Finally, the leaf area was calculated in cm^2 according to the following formula:

Leaf area = (a × y) / x; where a = area of the A4 paper in cm^2, y = weight of the cut paper in g, x = weight of the A4 paper in g.

Evaluation of chlorophylls

Spectrophotometric determination was performed for the estimation of Chlorophyll a (Chl *a*), chlorophyll b (Chl *b*), total chlorophyll and carotenoid contents according to the method of (Arnon, 1949). Leaves from controlled and 'stressed plants were excised and immediately processed to determine the chlorophylls. Leaves (0.05 g) were homogenised in 5 ml of ice cold buffered aqueous acetone (80% aqueous acetone containing sodium phosphate buffer) on a pre-chilled mortar pestle (kept on ice). The extract was centrifuged for 6 minutes at 8000 rpm in a cooling centrifuge at 4 °C. Absorbance was measured at 645, 652, 663 and 470 nm by spectrophotometer. Chl a, chl b and total chl were calculated according to the following formula:

Chl a = [(12.7 × OD at 663 nm) - (2.69 × OD at 645 nm)] × volume/ weight/1000

Chl b = [(22.9 × OD at 645 nm) - (4.68 × OD at 663 nm)] × volume/ weight/ 1000

Total chl = [(20.2 × OD at 645 nm) + (8.02 × OD at 663 nm)] × volume/ weight/ 1000

Determination of polyphenols

Slightly modified Folin–ciocalteau method was used to obtain total phenolic content (Singleton *et al*., 1999; Chakraborty and Mandal, 2008), it is expressed as mg gallic acid equivalents per g fresh weight. The plant material (0.01 g) was weighed and homogenised in 3 mL of 80% methanol. The sample was centrifuged at 10,000 rpm for 20 minutes. Subsequently, the supernatant was collected, evaporated it to dryness and 3 ml of distilled water was added. Then, Folin-ciocalteau reagent (0.5 mL) was mixed and the solution incubated for 5 minutes at room temperature. 2 mL of 20% sodium carbonate was then added to the solution and absorbance was measured at 650 nm using spectrophotometer. A series of gallic acid as standard was also prepared to calculate the total phenolic content.

Estimation of protein

Proteins were estimated by (Lowry *et al*., 1951) method. Firstly, copper solution was prepared by mixing 50 cm^3 of 0. 2% $NaCO_3$ dissolved in 0.1 N NaOH and 0.1 cm^3 of 0.5% $CuSO_4$ dissolved in 1% Potassium sodium tartrate. Five millilitres of this copper solution (alkaline) was mixed with the samples. After incubation period of 10 minutes these tubes were further mixed with Folin's ciocalteau reagent and assorted well. All the tubes were kept for 30 minutes in the dark. After the emergence of blue colour, absorbance was recorded at 660 nm and compared with previously prepared standard bovine serum albumin.

Determination of proline

Proline was evaluated by the protocol of (Bates *et al*., 1973). Samples were homogenised (300 mg) in sulfosalicylic acid (5 mL) then mixed with acid ninhydrin and glacial acetic acid (1 mL each). Toluene (4 mL) was added after 1 hour and finally absorbance of chromatophores was recorded at 520 nm.

Statistical analysis

The results are presented as mean value (n=9) of nine replicates. The data are examined by Analysis of Variance i.e. ANOVA method. The results were analysed statistically with SPSS-20 statistical software (SPSS IBM). Three way interactions were evaluated among selected genotypes against *Botrytis cinerea* infection. For each of the output variable, Tukey's post hoc multiple comparison test was used. Pearson's correlation analysis was also employed at ≤0.05% to compare the data of the variance from the incidence of infection among all the *Arachis* cultivars. All data presented as Mean ±Standard error.

Results

Growth analysis

Arachis cultivars showed statistically significant variation with respect to biochemical and growth parameters. Post inoculation, with time, the symptoms of *B. cinerea* became visible on all the ten cultivars of *A. hypogaea*. A critical monitoring was made regarding the effects of fungus invasion on the plant's growth accordingly at 5^{th}, 10^{th}, 15^{th}, 20^{th}, 25^{th} and 30^{th} day. The growth parameters such as root length of root and shoot, fresh and dry weight, dry mass and leaf area exhibited a significant decline due to the infection of *Botrytis*. Shoot and leaves were found most sensitive to *B. cinerea* than the roots (Table 1 and 2). A decline in the length of shoots and roots was experiential with *Botrytis* as compared to the control plant. *Botrytis* infection caused a continuous decrease in dry and fresh weight of the plant. The maximum reduction of root moisture percent was observed in the cultivar, RJ382 with the fungal inoculation as compared to control. Based on root length percentage the least readings obtained for RJ510 (24.2, 23.3, 11.3, 9.4) and maximum for RJ382 (56.3, 53.8, 67.3, 69.5). Percent shoot length inhibition was found least in RJ510 (20.7, 14.0, 12.0, 6.3) and greatest in RJ382 (38.8, 36.5, 39.1, 40.4) at 5, 10, 15, 20, 25 and 30 days, respectively (Table 1 & 2). The sequence of cultivars in term of reduction of growth was RJ510 > RG578 > Gangapuri > GG20 > Somnath > BAU13 > M13 > J11 > GG7 > RJ382. At all growth stages, the fresh weight of shoot and root, dry weight, length of root and shoot in *B. cinerea* showed a significant decrease in susceptible cultivars.

Disease severity index

The disease severity index was calculated for *B. cinerea* infected cultivars. The least disease severity score was found in RJ510 (0.6) while it was maximum in RJ382 (3.1).

Leaf area

Leaf area of selected cultivars was calculated. The reduction in leaf area was found 13.3 cm^2 in RJ382 and it was 17.6 cm^2 in cultivar RJ510 (Table 1).

Polyphenol content

Higher amount of polyphenol content was found in all treated plants. The estimations were done at the pre-decided intervals. In RJ510, the content of polyphenol was recorded at a high level at 10^{th} day and escalated further till the 30^{th} day of growth. Similarly, in RJ382 the phenolic content started to elevate after 5^{th} days of infection but, unlike RJ510, a slight decrease was observed afterward. The rate of this increase was recorded much higher in infected plants compared to the controlled plant. Phenolic content was also observed radically higher in inoculated plants (6.03 $\mu g\ mg^{-1}$ fresh weight) than the controlled plants (5.72 $\mu g\ mg^{-1}$ fw). In case of non inoculated plants RJ510 and RJ382 it was recorded (4.67$\mu g\ mg^{-1}$ fw) and (4.9 $\mu g\ mg^{-1}$ fw) *i.e.* higher in inoculated plants (Table 3).

Total Protein content

Protein content was recorded higher in controlled plants compared to the treated plants, for both the cultivars. Among the treated plants, protein content was slightly decreased in *Botrytis cinerea* infected susceptible cultivar RJ382 (4.43 $mg\ g^{-1}$ fw) and non inoculated plant (3.73 $mg\ g^{-1}$ fw). While, inoculated resistant cultivar RJ510, showed highest protein content (4.54 $mg\ g^{-1}$ fw) i.e., more than the non inoculated plant (3.83 $mg\ g^{-1}$ fw) (Table 4).

Chlorophyll content

Photosynthetic pigments in leaves of infected cultivars of *A. hypogea* showed a decline. The chl *a*, chl *b*, total chlorophyll and carotenoids vary significantly upon *Botrytis cinerea* infection. However, almost insignificant decrease was found at 5^{th} day of fungal infection and thereafter significant decline was observed at day 10^{th}, 15^{th}, 20^{th}, 25^{th}, and 30^{th} for all the cultivars. The decrease in chl *a* was more pronounced amongst all the photosynthetic pigments. The content of chl *a* in RJ510 was 25%, 13%, 27% to 20% whereas, in RJ382 it decreased by 47%, 52%, 43% and 49% at 10, 15, 20, 25, 30 day of infection. While the decrease in chl *b* in RJ510 was 7%, 9%, 17% and 30% whereas in RJ382 the decrease was 29%, 48%, 38% and 31% at 10,15, 20, 25, 30 day of infection. The carotenoid content diminished severely in RJ510 whereas, it increased initially in RJ382 and thereafter decreased slightly at 10^{th} day. The decrease in carotenoid content in RJ510 was 18%, 22%, 37% and 32% whereas RJ382 it decreased by 44%, 38%, 41% and 39% at 10^{th},15^{th}, 20^{th}, 25^{th}, 30^{th} day of infection (Table 5 and 6).

Proline content

Proline content was significantly increased in the inoculated plants as compared to the control plant. The highest amount of proline content (4.33 $\mu g\ g^{-1}$) observed in inoculated plant of cultivar RJ510, and 3.91 $\mu g\ g^{-1}$ in non- inoculated plants at the 25^{th} day. Similarly, proline was observed as 3.67 $\mu g\ g^{-1}$ in non inoculated plant of RJ382 and 3.84 $\mu g\ g^{-1}$ in inoculated plant of RJ382 at 25^{th} day. The study suggests proline accumulation was more in inoculated plants than non inoculated (Table 7)

Discussion

During this study, the screening based on various growth parameters of ten cultivars of *Arachis hypogaea* against *B. cinerea* was performed. Among the ten studied cultivars of *A. hypogaea*, the cultivar RJ510 was established as the most resistant and RJ382 came out as the most sensitive. There was a striking decline noted in the fresh weight of all the cultivars in response to fungal infection. An incessant decline in shoot length was also observed. The experiments were later conducted with inoculated cultivars, RJ510 and RJ382, a marked physiological change was observed in the screening. Results reveal that the level of proline, polyphenol and protein increases in the treated plants compared to the non-inoculated, disease free plants. A noteworthy decline in photosynthetic pigments was also observed in treated plant compared to controlled plant. A decrease in fresh weight was observed in infected plants compared to the controlled plants of the selected cultivars; an incessant decline in shoot length of the plant was also observed. These results are in agreement with the earlier studies performed by Ali *et al*. (1990), Ma *et al*. (2001) and Rahman *et al*. (2011) who reported a marked augmentations in proline, polyphenol and protein contents in all the treated plant compared to the controlled plants in their experiments. In the same way, the activities of these were reported higher in the present study in case of RJ510 (resistant cultivar) and lesser in RJ382 (susceptible cultivar).

The total protein content was recorded at higher levels in inoculated and non-inoculated cultivars both, the similar observation was made by (Khan *et al*., 2001) when they worked on leaf spot pathogen (*Drechslera sorghicola*) infected Sorghum. They showed an increased level of total soluble protein with the advancement of infection, which reaches up to its maximum after pathogen attack. In a study on *F. oxysporum* infected *Arabidopsis thaliana* plants an increase in protein levels against the pathogen assault was observed (Masachis *et al*., 2016).

Several evidences suggested that higher level of proline provokes an antioxidative defense response and pathogenesis related (PR) proteins when exposed any stress (Bouterfas *et al*., 2016). Proline considered as a key constituent of proteins which plays an imperative role in plant metabolism during defense response. A positive correlation confers that proline accumulation plays a crucial role in flowering and development both as a metabolite and signal molecule (Chatterjee and Ghosh, 2008; Mattioli *et al.*, 2009; Rajeswari *et al.*, 2015).

This study showed that the polyphenol content was rich in inoculated plant compared to the controlled plants, in case of cultivar RJ510 it was 5.98 mg g^{-1} fw for RJ382 the content was 4.68 mg g^{-1} fw. During an experiment on *F. oxysporum* infected tomato (*Solanum lycopersicum*) fruits (Panina *et al*., 2007) detected an increase in the phenolic acid linked to resistance response. They concluded that in the host plant, the proline and phenol compounds act as vital components in adaptive mechanism to sustain against the fungal infection. At the infection site, the accumulation of proline and phenolic compounds has been positively correlated with the restriction in the development of pathogen, and creates toxicity for pathogens.

As a final upshot of this study based on the above parameters, the cultivar RJ510 was found most tolerant against the fungal infection and appeared as the most unwilling to get the infection due to rapid up-gradation of defensive metabolism.

In present scenario, human health is the most affected due to frequent use of fungicides and other chemicals and to restrict this conventional approach of plant protection, the most reliable and safe mode for the control of fungal disease is to make use of resistant cultivars. *B. cinerea* is the common fungus which causes greater yield loss in *A. hypogaea*. As an alternative of fungicides, the use of tolerant cultivars in infection prone zones will be a passable ploy to protect the plants at the seedling stage. Further, if we have resistant cultivars then they will be further useful in breeding programmes to improve the other susceptible varieties also.

Conclusion

The present study is an attempt to understand the differential behaviour of contrasting ten *Arachis* cultivars in response to *Botrytis cinerea.* A positive relationship was observed among screening and photosynthetic pigment, proline, polyphenol content and total protein content to the tolerance of cultivar RJ510.

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Table 1: Effect of *Botrytis cinerea* on shoot fresh weight, dry weight, shoot length, leaf area, shoot moisture and shoot inhibition of ten cultivars of *Arachis hypogaea* (5, 10, 15, 20, 25 and 30 day) old plant.

Varieties	**Shoot fresh wt. (g)**		**Shoot dry wt. (g)**		**Shoot length (cm)**		**Leaf area (cm^2)**		**Shoot moisture (%)**		**Shoot Inhibition (%)**
	C	**I**	**C**	**I**	**C**	**I**	**C**	**I**	**C**	**I**	
5 th Day											
RJ510	1.588 ±0.222	1.128 ±0.056	0.043 ±0.001	0.037 ±0.002	12.1 ±0.338	10.2 ±0.568	17.6 ±0.476	15.7 ±0.824	97.25	96.66	16.16
RJ578	1.349 ±0.019	1.151 ±0.025	0.047 ±0.005	0.032 ±0.002	12.0 ±0.366	11.0 ±0.176	16.6 ±0.952	12.3 ±0.476	96.49	97.16	8.310
Gangapuri	0.954 ±0.166	0.901 ±0.322	0.039 ±0.003	0.024 ±0.001	9.96 ±0.260	9.46 ±0.384	13.3 ±1.259	11.9 ±2.519	95.91	97.30	5.016
GG20	1.306 ±0.318	1.083 ±0.031	0.032 ±0.003	0.033 ±0.001	10.5 ±0.950	9.76 ±0.688	12.3 ±0.476	9.04 ±0.476	97.49	96.89	6.984
Somnath	1.271 ±0.351	1.156 ±0.039	0.036 ±0.002	0.028 ±0.001	11.2 ±0.896	10.4 ±0.622	11.9 ±0.476	10.9 ±1.259	96.87	97.54	6.845
BAU13	1.119 ±0.038	1.065 ±0.031	0.032 ±0.002	0.029 ±0.002	12.2 ±0.450	10.8 ±0.290	12.8 ±2.474	10.4 ±1.716	97.08	97.27	10.92
M13	1.017 ±0.449	0.951 ±0.145	0.031 ±0.004	0.031 ±0.003	9.93 ±0.676	9.56 ±0.240	13.8 ±0.954	9.52 ±0.476	96.95	96.74	3.691
J11	1.115 ±0.039	1.077 ±0.037	0.036 ±0.004	0.030 ±0.003	10.3 ±0.133	10.1 ±0.260	12.8 ±0.824	9.04 ±1.259	96.72	97.15	1.612
GG7	1.129 ±0.070	0.980 ±0.307	0.028 ±0.001	0.026 ±0.001	11.2 ±0.321	10.3 ±0.240	10.4 ±2.651	8.09 ±0.952	97.93	97.28	7.440

RJ382	1.272 ±0.202	1.25 6±0.05	0.038 ±0.006	0.034 ±0.002	11.1 ±0.240	10.7 ±0.272	13.3 ±1.259	10.9 ±1.259	96.96	97.29	3.582
10th Day											
RJ510	1.956 ±0.075	1.136 ±0.063	0.062 ±0.003	0.056 ±0.001	17.0 ±0.296	13.7 ±0.529	20.4 ±1.716	17.1 ±1.428	96.79	95.04	19.56
RJ578	1.793 ±0.170	1.141 ±0.021	0.054 ±0.002	0.049 ±0.003	17.1 ±0.145	13.8 ±0.328	16.1 ±0.476	14.2 ±0.824	96.98	95.67	19.26
Gangapuri	1.182 ±0.032	1.139 ±0.004	0.046 ±0.002	0.044 ±0.001	13.2 ±0.305	12.7 ±0.409	14.2 ±1.428	11.9 ±0.476	96.10	96.13	3.535
GG20	1.502 ±0.227	1.144 ±0.050	0.053 ±0.003	0.041 ±0.004	16.7 ±0.290	12.6 ±0.517	12.8 ±1.428	12.7 ±1.716	96.45	96.38	24.30
Somnath	1.180 ±0.040	1.134 ±0.007	0.057 ±0.006	0.038 ±0.002	13.7 ±0.317	11.8 ±0.152	14.7 ±0.952	11.4 ±0.824	95.14	96.62	14.07
BAU13	1.650 ±0.193	1.106 ±0.018	0.064 ±0.002	0.038 ±0.002	16.6 ±1.006	10.7 ±0.057	13.8 ±0.476	12.8 ±1.649	96.08	96.05	35.54
M13	1.407 ±0.250	1.147 ±0.019	0.050 ±0.002	0.040 ±0.003	14.4 ±0.520	12.0 ±0.606	13.3 ±2.896	12.3 ±0.476	96.39	96.45	16.39
J11	1.372 ±0.105	1.131 ±0.010	0.052 ±0.004	0.036 ±0.003	15.2 ±0.264	11.6 ±0.272	13.8 ±3.122	13.8 ±1.716	96.16	96.78	23.46
GG7	1.312 ±0.030	1.122 ±0.023	0.054 ±0.005	0.031 ±0.001	15.1 ±0.317	11.3 ±0.145	18.0 ±2.651	12.8 ±0.824	95.83	97.20	25.27
RJ382	1.308 ±0.192	1.127 ±0.029	0.048 ±0.003	0.037 ±0.004	14.3 ±0.907	10.8 ±0.384	15.7 ±2.857	13.3 ±1.259	96.28	96.65	24.24
15th Day											
RJ510	2.367 ±0.174	1.206 ±0.496	0.078 ±0.003	0.058 ±0.001	21.3 ±0.895	15.3 ±0.328	23.3 ±1.716	20.4 ±2.651	96.70	95.19	28.12
RJ578	2.269 ±0.358	1.174 ±0.040	0.073 ±0.001	0.055 ±0.003	19.4 ±0.674	14.3 ±0.405	20.9 ±1.259	19.5 ±4.068	96.76	95.31	26.19
Gangapuri	1.864 ±0.207	1.189 ±0.043	0.059 ±0.003	0.049 ±0.004	16.1 ±0.120	13.3 ±0.290	21.4 ±2.474	19.0 ±3.122	96.81	95.88	17.14
GG20	2.184 ±0.146	1.161 ±0.027	0.061 ±0.005	0.052 ±0.003	19.8 ±0.838	13.1 ±0.503	18.9 ±2.896	19.5 ±2.651	97.19	95.46	33.83
Somnath	2.048 ±0.309	1.181 ±0.038	0.065 ±0.001	0.044 ±0.003	17.7 ±0.788	12.3 ±0.260	19.5 ±2.519	18.0 ±1.259	96.79	96.24	30.45
BAU13	2.144 ±0.040	1.117 ±0.018	0.071 ±0.004	0.046 ±0.004	18.7 ±0.717	11.1 ±0.145	21.9 ±2.519	19.5 ±1.259	96.68	95.82	40.39
M13	1.518 ±0.216	1.160 ±0.040	0.063 ±0.002	0.041 ±0.002	17.7 ±0.351	12.6 ±0.635	17.1 ±2.182	16.6 ±1.904	95.82	96.40	28.62
J11	1.595 ±0.307	1.143 ±0.011	0.059 ±0.004	0.039 ±0.001	17.4 ±0.523	12.0 ±0.260	20.9 ±0.476	19.5 ±0.476	96.28	96.55	30.78
GG7	1.864 ±0.291	1.129 ±0.011	0.055 ±0.010	0.046 ±0.002	18.2 ±0.821	11.8 ±0.033	18.5 ±3.299	16.1 ±1.716	97.03	95.86	35.03
RJ382	1.560 ±0.450	1.114 ±0.025	0.057 ±0.002	0.038 ±0.001	16.9 ±0.317	11.3 ±0.550	19.0 ±0476	15.2 ±3.122	96.34	96.53	33.26
20th Day											
RJ510	2.829 ±0.265	1.245 ±0.007	0.085 ±0.001	0.067 ±0.003	24.7 ±0.176	17.7 ±0.328	25.7 ±1.259	23.3 ±0.476	96.41	94.78	34.17
RJ578	2.567 ±0.147	1.186 ±0.026	0.083 ±0.002	0.063 ±0.001	23.8 ±0.338	15.8 ±0.466	22.3 ±1.259	21.4 ±0.824	96.51	95.10	27.74
Gangapuri	2.306 ±0.635	1.193 ±0.023	0.077 ±0.005	0.057 ±0.005	20.0 ±0.927	15.1 ±0.472	21.9 ±0.476	20.4 ±1.259	96.81	95.25	32.97
GG20	2.288 ±0.451	1.176 ±0.023	0.082 ±0.002	0.061 ±0.003	23.7 ±1.096	15.6 ±0.624	21.4 ±0.824	20.9 ±2.075	96.48	94.32	25.58
Somnath	2.125 ±0.527	1.192 ±0.034	0.074 ±0.002	0.058 ±0.002	21.2 ±1.105	15.3 ±0.405	20.0 ±1.649	22.3 ±2.381	96.41	94.78	34.17
BAU13	2.354 ±0.076	1.124 ±0.018	0.075 ±0.003	0.053 ±0.002	21.8 ±0.751	14.6 ±0.611	21.4 ±2.182	21.9 ±1.716	96.51	95.10	27.74
M13	2.068 ±0.524	1.198 ±0.036	0.072 ±0.008	0.068 ±0.004	21.5 ±0.152	16.0 ±0.360	19.0 ±1.259	18.5 ±1.428	96.81	95.25	32.97
J11	1.839 ±0.326	1.163 ±0.015	0.072 ±0.003	0.042 ±0.005	22.1 ±0.338	14.7 ±0.272	19.5 ±2.075	17.6 ±2.651	96.41	96.33	33.38
GG7	2.069 ±0.093	1.137 ±0.006	0.070 ±0.002	0.048 ±0.001	22.9 ±0.949	12.1 ±0.272	20.4 ±4.542	17.1 ±0.824	96.60	95.71	47.16
RJ382	2.035 ±0.472	1.121 ±0.005	0.073 ±0.003	0.039 ±0.001	20.9 ±0.351	11.9 ±0.351	21.4 ±1.649	16.5 ±0.476	96.38	96.46	43.06
25th Day											
RJ510	3.013 ±0.388	1.257 ±0.004	0.089 ±0.002	0.071 ±0.004	26.8 ±0.230	18.1 ±0.296	26.6 ±2.075	25.2 ±0.952	97.02	94.32	32.21

RJ578	2.945 ±0.177	1.219 ±0.033	0.084 ±0.002	0.069 ±0.004	26.5 ±0.529	16.3 ±0.321	24.2 ±2.182	23.8 ±0.476	97.14	94.34	38.49
Gangapuri	2.646 ±0.128	1.199 ±0.030	0.078 ±0.001	0.058 ±0.002	24.2 ±0.705	15.8 ±0.472	24.7 ±0.952	22.8 ±2.474	97.03	95.13	34.80
GG20	2.529 ±0.242	1.187 ±0.025	0.085 ±0.001	0.066 ±0.001	25.9 ±0.768	16.0 ±0.611	23.8 ±2.381	21.9 ±3.333	96.63	94.44	38.12
Somnath	2.307 ±0.380	1.204 ±0.040	0.077 ±0.002	0.067 ±0.001	24.3 ±1.034	15.6 ±0.536	21.9 ±2.075	21.4 ±1.428	96.63	94.38	35.75
BAU13	2.487 ±0.368	1.603 ±0.021	0.076 ±0.001	0.070 ±0.002	23.6 ±0.263	15.1 ±0.693	24.3 ±2.075	23.3 ±1.259	96.94	93.90	35.73
M13	2.409 ±0.259	1.188 ±0.034	0.074 ±0.001	0.071 ±0.002	23.4 ±0.208	16.0 ±0.264	20.0 ±2.474	21.4 ±2.182	96.92	94.02	31.62
J11	1.945 ±0.378	1.171 ±0.001	0.070 ±0.002	0.044 ±0.001	24.3 ±0.953	15.5 ±0.272	21.4 ±0.824	20.4 ±1.259	96.38	96.21	36.07
GG7	2.247 ±0.067	1.148 ±0.030	0.076 ±0.001	0.049 ±0.002	24.1 ±1.234	12.4 ±0.272	23.3 ±1.259	19.5 ±0.476	96.61	95.67	48.48
RJ382	2.207 ±0.046	1.119 ±0.001	0.074 ±0.002	0.038 ±0.002	22.7 ±1.203	11.5 ±0.384	24.2 ±0.824	19.0 ±1.716	96.61	96.60	49.19
30th Day											
RJ510	3.090 ±0.018	1.268 ±0.004	0.107 ±0.001	0.073 ±0.001	31.2 ±0.296	21.4 ±0.832	28.0 ±1.259	26.6 ±0.476	96.79	94.21	31.48
RJ578	3.066 ±0.204	1.231 ±0.036	0.102 ±0.005	0.070 ±0.001	30.1 ±0.240	19.3 ±0.617	25.7 ±2.182	24.8 ±2.474	96.72	94.26	35.80
Gangapuri	3.035 ±0.378	1.203 ±0.030	0.097 ±0.004	0.064 ±0.001	27.8 ±0.033	17.4 ±0.750	26.1 ±0.952	23.3 ±1.259	96.78	94.67	37.48
GG20	2.751 ±0.245	1.195 ±0.048	0.089 ±0.004	0.067 ±0.002	29.3 ±0.650	18.4 ±0.497	25.7 ±2.182	22.8 ±0.824	96.74	94.34	36.97
Somnath	2.557 ±0.359	1.219 ±0.036	0.093 ±0.001	0.072 ±0.005	27.7 ±0.876	17.0 ±0.655	26.6 ±2.075	20.9 ±2.896	96.79	94.21	31.48
BAU13	2.643 ±0.063	1.168 ±0.037	0.100 ±0.002	0.074 ±0.003	26.4 ±0.435	17.2 ±1.234	27.1 ±2.182	21.9 ±1.259	96.35	94.09	38.77
M13	2.628 ±0.402	1.193 ±0.022	0.094 ±0.003	0.072 ±0.001	26.8 ±0.883	17.4 ±0.862	27.6 ±2.381	22.8 ±0.824	96.20	93.66	34.59
J11	2.158 ±0.025	1.182 ±0.030	0.091 ±0.004	0.045 ±0.003	27.3 ±0.608	16.8 ±1.040	25.7 ±2.182	19.5 ±0.952	96.41	93.96	35.23
GG7	2.395 ±0.077	1.154 ±0.029	0.087 ±0.002	0.049 ±0.003	26.3 ±0371	13.9 ±1.200	29.5 ±2.075	20.0 ±2.474	95.76	96.13	38.46
RJ382	2.239 ±0.026	1.118 ±0.003	0.091 ±0.002	0.037 ±0.001	26.1 ±0.548	11.4 ±0.617	27.1 ±1.649	20.4 ±2.075	96.34	95.69	47.15

(C=Control; I=Infected)

Table 2: Effect of *Botrytis cinerea* on root fresh weight, dry weight, root length, root moisture, and root inhibition of ten cultivars of *Arachis hypogaea* (5, 10, 15, 20, 25 and 30 day old) plants.

Varieties	Fresh Weight Root (g)		Dry Weight Root (g)		Root Length (cm)		Root Moisture (%)		Root Inhibition (%)
	C	I	C	I	C	I	C	I	
5th Day									
RJ510	0.625 ±0.014	0.616 ±0.017	0.031 ±0.001	0.025 ±0.002	10.4 ±0.400	9.83 ±0.066	94.99	95.94	5.488
RJ578	0.623 ±0.014	0.611 ±0.010	0.026 ±0.001	0.022 ±0.003	9.83 ±0.145	8.93 ±0.523	95.77	96.39	9.152
Gangapuri	0.610 ±0.013	0.601 ±0.015	0.028 ±0.001	0.022 ±0.001	10.2 ±0.384	9.43 ±0.176	95.36	96.23	8.116
GG20	0.605 ±0.016	0.594 ±0.010	0.024 ±0.001	0.019 ±0.003	9.06 ±0.272	8.13 ±0.589	95.97	96.74	10.29
Somnath	0.600 ±0.011	0.589 ±0.012	0.025 ±0.002	0.019 ±0.001	9.66 ±0.328	9.16 ±0.338	95.78	96.77	5.172
BAU13	0.594 ±0.011	0.577 ±0.010	0.022 ±0.001	0.021 ±0.002	9.83 ±0.409	8.43 ±0.120	96.24	96.36	14.23
M13	0.577 ±0.005	0.567 ±0.009	0.025 ±0.002	0.020 ±0.002	9.76 ±0.290	8.43 ±0.218	95.67	97.00	13.65
J11	0.574 ±0.004	0.557 ±0.002	0.023 ±0.001	0.018 ±0.003	10.0 ±0.296	9.46 ±0.033	95.87	96.71	5.647
GG7	0.607 ±0.008	0.550 ±0.015b	0.026 ±0.001	0.017 ±0.002	9.26 ±0.384	9.23 ±0.417	95.60	96.79	0.359
RJ382	0.611 ±0.006	0.548 ±0.013	0.025 ±0.001	0.016 ±0.001	9.06 ±0.333	9.86 ±0.317	95.79	96.96	2.205

10 th Day									
RJ510	0.638 ±0.013	0.630 ±0.016	0.035 ±0.002	0.028 ±0.001	12.2 ±0.260	10.7 ±0.120	94.46	95.55	12.50
RJ578	0.633 ±0.010	0.622 ± 0.008	0.032 ±0.003	0.024 ±0.002	11.7 ±0.548	10.5 ±0.115	94.84	96.03	10.76
Gangapuri	0.638 ±0.011	0.618 ± 0.008	0.033 ±0.001	0.022 ±0.001	11.8 ±0.371	10.1 ±0.284	94.72	96.39	14.60
GG20	0.622 ±0.006	0.605 ±0.015	0.030 ±0.001	0.023 ±0.003	10.5 ±0.200	9.63 ±0.284	95.17	96.20	8.253
Somnath	0.626 ±0.004	0.602 ±0.012	0.033 ±0.002	0.025 ±0.002	11.3 ±0.185	10.3 ±0.762	94.67	95.73	9.090
BAU13	0.608 ±0.007	0.611 ±0.005	0.029 ±0.001	0.023 ±0.002	12.0 ±0.088	9.93 ±0.520	95.12	96.18	17.45
M13	0.608 ±0.005	0.583 ±0.010	0.031 ±0.001	0.024 ±0.002	12.1 ±0.233	10.3 ±0.554	94.79	95.82	17.30
J11	0.591 ±0.005	0.580 ±0.003	0.028 ±0.001	0.024 ±0.002	11.6 ±0.405	10.8 ±0.545	95.26	95.83	6.857
GG7	0.617 ±0.008	0.556 ±0.016	0.030 ±0.001	0.022 ±0.001	11.4 ±0.264	10.9 ±0.115	95.14	96.04	4.385
RJ382	0.616 ±0.003	0.554 ±0.015	0.031 ±0.001	0.019 ±0.001	11.3 ±0.120	10.1 ±0.433	95.80	95.57	10.85
15 th Day									
RJ510	0.658 ±0.015	0.639 ± 0.009	0.048 ±0.002	0.039 ±0.003	17.1 ±0.284	14.2 ±0.290	92.65	93.84	16.92
RJ578	0.648 ±0.011	0.630 ±0.008	0.044 ±0.005	0.035 ±0.002	16.9 ±0.088	13.5 ±0.463	93.10	94.45	20.07
Gangapuri	0.645 ±0.009	0.629 ±0.007	0.039 ±0.001	0.038 ±0.004	16.7 ±0.346	13.8 ±0.173	93.85	93.88	17.36
GG20	0.644 ±0.006	0.621 ±0.007	0.047 ±0.005	0.041 ±0.003	15.3 ±0.360	12.8 ±0.768	92.59	93.40	15.90
Somnath	0.640 ±0.005	0.610 ±0.014	0.045 ±0.001	0.032 ±0.001	15.9 ±0.405	13.9 ±0.218	92.92	94.69	12.55
BAU13	0.645 ±0.012	0.609 ±0.013	0.046 ±0.003	0.035 ±0.005	15.7 ±0.272	13.6 ±0.296	92.65	94.25	13.53
M13	0.627 ±0.009	0.603 ±0.002	0.047 ±0.005	0.028 ±0.003	16.4 ±0.384	12.6 ±0.881	92.50	95.30	23.27
J11	0.629 ±0.016	0.593 ±0.001	0.042 ±0.002	0.036 ±0.001	15.4 ±0.545	13.3 ±0.202	93.32	94.38	13.39
GG7	0.634 ±0.006	0.562 ±0.015	0.040 ±0.005	0.033 ±0.001	16.0 ±0.536	12.5 ±0.251	92.63	93.47	22.03
RJ382	0.630 ±0.004	0.566 ±0.003	0.038 ±0.002	0.027 ±0.003	15.8 ±0.360	12.7 ±0.517	93.91	95.17	19.19
20 th Day									
RJ510	0.678 ± 0.010	0.664 ± 0.011	0.069 ±0.003	0.058 ±0.004	23.2 ±0.270	18.2 ±0.351	89.72	91.14	21.66
RJ578	0.672 ±0.011	0.666 ± 0.014	0.071 ±0.004	0.063 ±0.005	24.6 ±0.260	17.1 ±0.417	89.39	90.54	30.54
Gangapuri	0.662 ± 0.004	0.654 ± 0.001	0.066 ±0.006	0.058 ±0.007	22.7 ±0.440	17.0±0.218	89.93	91.01	25.03
GG20	0.660 ±0.002	0.658 ±0.012	0.059 ±0.004	0.061 ±0.012	23.6 ±0.290	15.3 ±0.409	90.96	90.63	35.11
Somnath	0.655 ±0.003	0.627 ±0.015	0.067 ±0.008	0.053 ±0.010	24.2 ±0.448	17.3 ±0.321	89.67	91.44	28.61
BAU13	0.662 ±0.003	0.624 ±0.011	0.058 ±0.014	0.055 ±0.006	24.1 ±0.317	16.8 ±0.633	91.19	91.08	30.34
M13	0.657 ±0.007	0.608 ±0.010	0.063 ±0.001	0.063 ±0.005	24.7 ±0.066	16.6 ±0.305	90.31	89.58	32.88
J11	0.676 ±0.003	0.596 ±0.004	0.062 ±0.001	0.046 ±0.002	24.3 ±0.152	16.1 ±0.470	90.82	92.17	33.47
GG7	0.661 ±0.007	0.569 ±0.014	0.064 ±0.007	0.051 ±0.007	22.6 ±0.348	14.8 ±0.066	90.26	90.98	34.55
RJ382	0.654 ±0.009	0.567 ±0.003	0.061 ±0.002	0.044 ±0.002	22.8 ±0.513	14.5 ±0.650	90.68	92.18	36.40
25 th Day									
RJ510	0.710 ±0.001	0.688 ± 0.013	0.078 ±0.003	0.073 ±0.001	29.8 ±0.435	19.8 ±0.448	88.97	89.39	33.44

RJ578	0.704 ±0.002	0.687 ±0.005	0.077 ±0.001	0.068 ±0.005	28.1 ±0.384	18.5 ±0.360	89.01	90.10	34.24
Gangapuri	0.698 ±0.002	0.676 ±0.005	0.072 ±0.001	0.064 ±0.003	27.3 ±0.666	19.1 ±0.145	89.67	90.44	29.96
GG20	0.690 ±0.007	0.658 ±0.006	0.088 ±0.003	0.066 ±0.005	27.1 ±0.173	17.8 ±0.284	87.16	89.87	34.19
Somnath	0.682 ±0.015	0.685 ±0.008	0.075 ±0.002	0.063 ±0.006	28.2 ±0.115	18.9 ±0.290	88.91	90.76	32.86
BAU13	0.672 ±0.041	0.655 ±0.006	0.069 ±0.001	0.069 ±0.004	27.5 ±0.317	19.2 ±0.321	89.68	89.42	30.26
M13	0.693 ±0.003	0.658 ±0.001	0.074 ±0.001	0.067 ±0.001	28.0 ±0.405	18.6 ±0.152	89.32	89.82	33.65
J11	0.697 ±0.001	0.644 ±0.018	0.075 ±0.001	0.065 ±0.002	27.9 ±0.230	18.5 ±0.176	89.19	89.81	33.45
GG7	0.695 ±0.009	0.584 ±0.016	0.076 ±0.003	0.068 ±0.005	28.2 ±0.435	18.2 ±0.088	89.06	88.31	35.22
RJ382	0.683 ±0.001b	0.564 ±0.019	0.078 ±0.002	0.059 ±0.004	28.0 ±0.393	17.7 ±0.352	88.59	89.42	36.74
30 th Day									
RJ510	0.745 ± 0.009	0.697 ±0.003	0.103 ±0.002	0.091 ±0.003	32.8 ±0.218	23.3 ±0.400	86.12	86.85	29.10
RJ578	0.740 ±0.007	0.694 ±0.002	0.099 ±0.003	0.089 ±0.002	32.1 ±0.569	20.3 ±0.466	86.54	87.13	36.72
Gangapuri	0.723 ± 0.005	0.685 ±0.031	0.101 ±0.003	0.083 ±0.031	31.9 ±0.702	21.3 ±0.317	85.95	87.84	33.12
GG20	0.721 ±0.007	0.086 ±0.012	0.102 ±0.001	0.089 ±0.012	31.2 ±0.503	19.9 ±0.296	85.85	86.94	36.00
Somnath	0.731 ±0.009	0.695 ±0.001	0.095 ±0.001	0.077 ±0.001	32.2 ±0.417	21.5 ±0.145	86.91	88.93	33.09
BAU13	0.692 ±0.014	0.627 ±0.035	0.096 ±0.006	0.075 ±0.035	32.8 ±0.346	21.4 ±0.513	86.09	88.03	34.75
M13	0.701 ±0.003	0.624 ±0.014	0.101 ±0.005	0.074 ±0.014	31.1 ±0.375	20.9 ±0.240	85.59	88.14	32.72
J11	0.706 ±0.009	0.600 ±0.009	0.095 ±0.001	0.080 ±0.009	30.8 ±0.352	21.0 ±0.133	86.50	86.62	31.67
GG7	0.711 ±0.004	0.570 ±0.015	0.098 ±0.004	0.072 ±0.015	32.1 ±0.230	21.3 ±0.384	86.18	87.36	33.43
RJ382	0.715 ±0.004	0.565 ±0.003	0.094 ±0.007	0.067 ±0.003	31.5 ±0.592	20.1 ±0.145	86.85	88.03	36.21

Value are presented as mean ± S.E (n=12). (C=Control; I=Infected)

Table 3: Polyphenol content in two cultivars viz, RJ510 and RJ382 of 21 days old *A. hypogaea* plants after *Botrytis* inoculation.

Days	**Total polyphenol content (mg g^{-1})**			
	RJ510		**RJ382**	
	Control	***Botrytis***	**Control**	***Botrytis***
5	4.83±0.17b	4.92±0.03a	3.36±0.01b	3.41±0.01a
10	5.18±0.01a	5.41±0.12ab	3.75±0.03a	3.92±0.21a
15	5.31±0.12ab	6.32±0.16a	4.20±0.12a	4.48±0.11a
20	5.44±0.04a	7.43±0.10a	4.51±0.07ab	4.77±0.17a
25	5.56±0.11a	6.91±0.14a	4.58±0.13a	4.83±0.21a
30	5.72±0.05a	6.03±0.18a	4.67±0.07a	4.94±0.09a

Each value represents the mean of three replicates with SD (n=9). Means followed by different letters are significantly different (P<0.05) by Tukey's test.

Table 4: Protein content in two cultivars *viz*., RJ510 and RJ382 of 21 days old *A. hypogaea* plants after *Botrytis* inoculation.

Days	RJ510		RJ382	
	Control	***Botrytis***	**Control**	***Botrytis***
5	3.03±0.40a	3.22±0.24a	3.01±0.06a	3.07±0.03bc
10	3.24±0.02a	3.51±0.13a	3.14±0.17b	3.16±0.20c
15	3.41±0.18b	4.69±0.10b	3.20±0.11a	4.24±0.08c
20	3.65±0.08a	4.43±0.10b	3.29±0.11a	4.34±0.07ab
25	3.77±0.12b	5.73±0.13b	3.42±0.17a	4.59±0.12ab
30	3.83±0.16ab	4.54±0.64a	3.73±0.15a	4.43±0.05a

Each value represents the mean of three replicates with SD (n=9). Means followed by different letters are significantly different (P<0.05) by Tukey's test.

Table 5: The effect of *Botrytis cinerea* on photosynthetic pigments; Chl *a* and Chl *b*, Chl *a*/*b* and carotenoid ratio at 21 days after treatment in RJ510 variety.

Days	Chl *a* [mg g^{-1} fresh weight]		Chl *b* [mg g^{-1} fresh weight]		Chl *a*/*b* [mg g^{-1} fresh weight]		Carotenoid [mg g^{-1} fresh weight]	
	Control	***Botrytis***	**Control**	***Botrytis***	**Control**	***Botrytis***	**Control**	***Botrytis***
5	1.8 ±0.14	1.7 ±0.03	0.36 ±0.01	0.35 ±0.03	2.16 ±0.04	2.05 ±0.20	5.1 ±0.18	4.1 ±0.20
10	1.9 ±0.19	1.8 ±0.04	0.37 ±0.05	0.36 ±0.06	2.27 ±0.19	2.18 ±0.10	5.6c ±0.12	4.2 ±0.10
15	2.1 ±0.07	1.8 ±0.10	0.38 ±0.16	0.36 ±0.02	2.46 ±0.04	4.5 ±0.08	4.6 ±0.12	4.5 ±0.08
20	2.4 ±0.07	2.1 ±0.13	0.41 ±0.03	0.45 ±0.05	2.81 ±0.53	4.1 ±0.08	4.4 ±0.10	4.1 ±0.08
25	2.6 ±0.07	2.2 ±0.06	0.43 ±0.09	0.48 ±0.07	3.03 ±0.12	4.0 ±0.20	4.3 ±0.22	4.0 ±0.20
30	2.6 ±0.08	2.4 ±0.02	0.44 ±0.08	0.45 ±0.06	3.04 ±0.01	4.3 ±0.16	4.8 ±0.12	4.3 ±0.16

Each value represents the mean of three replicates with SD (n=9). Means followed by different letters are significantly different (P<0.05) by Tukey's test.

Table 6: The effect of *Botrytis cinerea* on photosynthetic pigments; Chl *a* and Chl *b*, Chl *a*/*b* and carotenoid ratio at 21 days after treatment in RJ382 variety.

Days	Chl *a* [mg g^{-1} fresh weight]		Chl *b* [mg g^{-1} fresh weight]		Chl *a*/*b* [mg g^{-1} fresh weight]		Carotenoid [mg g^{-1} fresh weight]	
	Control	***Botrytis***	**Control**	***Botrytis***	**Control**	***Botrytis***	**Control**	***Botrytis***
5	1.5 ±0.12	1.4 ±0.12	0.29 ±0.07	0.24 ±0.09	3.6 ±0.68	2.8 ±0.23	3.6 ±0.68	2.8 ±0.23
10	1.6 ±0.05	1.3 ±0.15	0.34 ±0.04	0.25 ±0.06	4.3 ±0.10	3.8 ±0.14	4.3 ±0.10	3.8 ±0.14
15	1.8 ±0.24	1.4 ±0.06	0.33 ±0.09	0.22 ±0.05	4.6 ±0.03	3.5 ±0.14	4.6 ±0.03	3.5 ±0.14
20	1.7 ±0.16	1.2 ±0.07	0.35 ±0.03	0.25 ±0.04	3.9 ±0.50	3.7 ±0.38	3.9 ±0.50	3.7 ±0.38
25	1.9 ±0.09	1.4 ±0.15	0.36 ±0.10	0.17 ±0.07	4.5 ±0.20	4.9 ±0.07	4.5 ±0.20	4.9 ±0.07
30	2.0 ±0.15	1.1 ±0.08	0.36 ±0.04	0.26 ±0.04	3.7 ±0.11	3.3 ±0.24	3.7 ±0.11	3.3 ±0.24

Each value represents the mean of three replicates with SD (n=9). Means followed by different letters are significantly different (P<0.05) by Tukey's test.

Table 7: Effect of *Botrytis* inoculation on total proline content in two cultivars viz. RJ510 and RJ382 of peanut (21 day old plants).

Days	Total proline content (mg g^{-1})			
	RJ510		RJ382	
	Control	*Botrytis*	Control	*Botrytis*
5	2.37±0.14a	2.42±0.01a	2.18±0.03a	2.31±0.01b
10	2.68±0.02a	2.71±0.22a	2.55±0.01a	2.85±0.01b
15	2.84±0.16ab	3.32±0.24a	2.74±0.01a	2.98±0.03a
20	3.44±0.05b	3.63±0.09c	2.89±0.05ab	3.27±0.04b
25	3.76±0.12b	4.21±0.03a	3.28±0.12bc	3.73±0.02a
30	3.91±0.09b	4.33±0.06a	3.67±0.17a	3.84±0.06a

Each value represents the mean of three replicates with SD (n=9). Means followed by different letters are significantly different ($P<0.05$) by Tukey's test.

References

Ali M, Quadir MA, Okubo H, Fujieda K, 1990. Resistance of eggplant, its wild relatives and their hybrids to different strains of Pseudomonas solanacearum. *Sci. Hort.*, **45**: 1-9.

Arnon DI, 1949. Copper enzymes in isolated chloroplasts. Polyphenoloxidase in *Beta vulgaris*. *Plant Physiol*., **24**: 1-15.

Bates LS, Waldren RP, Teare ID, 1973. Rapid determination of free proline for water-stress studies. *Plant Soil*, **39**: 205-207.

Bhattacharyya D, Basu S, Chattapadhyay JP, Bose SK, 1985. Biocontrol of Macrophomina root-rot disease of jute by an antagonistic organism, Aspergillus versicolor. *Plant Soil*, **87**: 435-438.

Bouterfas K, Mehdadi Z, Elaoufi MM, Latreche A, Benchiha W, 2016. Antioxidant activity and total phenolic and flavonoids content variations of leaves extracts of white Horehound (*Marrubium vulgare* Linné) from three geographical origins. *Ann. Pharm. Fr*., **74**: 453-462.

Chakraborty D, Mandal SM, 2008. Fractional changes in phenolic acids composition in root nodules of *Arachis hypogaea* L. *Plant Growth Regul*., **55**: 159-163.

Chakraborty K, Singh AL, Kalariya KA, Goswami N, 2015. Physiological responses of peanut (*Arachis hypogaea* L.) cultivars to water deficit stress: status of oxidative stress and antioxidant enzyme activities. *Acta Bot. Croat.,* **74**: 123-142.

Chatterjee, A. and Ghosh, S.K, 2008. Alterations in biochemical components in mesta plants infected with yellow vein mosaic disease. *Braz. J. Plant Physiol*., **20**: 267-275.

Khan AJ, Deadman ML, Al-Maqbali YM, Al-Sabahi J, Srikandakumar A, Rizvi SG, 2001. Biochemical changes in sorghum leaves infected with leaf spot pathogen, *Drechslera sorghicola*. *Plant Pathol. J.* **17**: 342-346.

Kumari N, Sharma I, Alam A, Sharma V, 2015. Screening of sorghum genotypes and biochemical changes for resistance to damage caused by *Macrophomina phaseolina*. *Arch. Phytopathol. Plant Prot*., **48**: 760-775.

Lakshmi JS, Kuberan T, Sundaravadivelan JA, Kumar P, Dhanaseeli M, 2011. Effect of plant growth promoting fungal inoculants on the growth of *Arachis hypogaea* (L.) and its role on the induction of systemic resistance against Rhizoctonia solani. *Asian J. Biol. Sci*., **6**: 131-139.

Lowry OH, Rosebrough NJ, Farr AL, Randall RJ, 1951. Protein measurement with the Folin phenol reagent. *J. Biol. Chem.*, **193**: 265-75.

Ma Z, Morgan DP, Michailides TJ, 2001. Effects of water stress on Botryosphaeria blight of pistachio caused by *Botryosphaeria dothidea*. *Plant Dis*., **85**: 745-749.

Madhusudhana B, 2013. A survey on area, production and productivity of groundnut crop in India. *IOSR-JEF*., **1**: 1-7.

Masachis S, Segorbe D, Turrà D, Leon-Ruiz M, Fürst U, El Ghalid M, Leonard G, López-Berges MS, Richards TA, Felix G, Di Pietro A, 2016. A fungal pathogen secretes plant alkalinizing peptides to increase infection. *Nat. Microbiol.*, **1**: 16043.

Mattioli R, Costantino P, Trovato M, 2009. Proline accumulation in plants: not only stress. *Plant Signal Behav*., **4**: 1016-1018.

Misra C, 2017. Trends in area production and productivity of groundnut in India: Issues & Challenges. *J. Res. Agric. Anim. Sci*., **7**: 1-6.

Nain L, Yadav RC, Saxena J, 2012. Characterization of multifaceted *Bacillus* sp. RM-2 for its use as plant growth promoting bioinoculant for crops grown in semi arid deserts. *Appl. Soil Ecol.,* **59**: 124-135.

Panina Y, Fravel DR, Baker CJ, Shcherbakova LA,

2007. Biocontrol and plant pathogenic *Fusarium oxysporum* induced changes in phenolic compounds in tomato leaves and roots. *J. Phytopathol*., **155**: 475-481.

Rahman MA, Ali F, Hossain KA, 2011. Shoot and root growth and yield of eggplant cultivars as affected by wilt disease. *J. Exp. Sci.* **13**: 11-15.

Rajeswari P, 2015. Control of *Fusarium oxysporum* Causing *Fusarium* Wilt by *Trichoderma* Spp and Pseudomonas fluorescens on *Arachis hypogaea* L. *Int. J. Adv. Biotechnol. Res*., **6**: 57-65.

Rao PS, Strange RN, 1994. Chemistry, biology, and role of groundnut phytoalexins in resistance to fungal attack. Handbook of Phytoalexin Metabolism and Action; (Eds) Daniel M, Purkayastha RP, Ch. 6, pp. 199-227.

Ren W, Shao W, Han X, Zhou M, Chen C, 2016. Molecular and biochemical characterization of laboratory and field mutants of *Botrytis cinerea* resistant to fludioxonil. *Plant Dis*., **100**: 1414-1423.

Singleton VL, Orthofer R, Lamuela-Raventós RM, 1999. Analysis of total phenols and other oxidation substrates and antioxidants by means of folin-ciocalteu reagent. *Methods Enzymol*., **1**: 152-178.

Sobolev VS, Deyrup ST, Gloer JB, 2006. New peanut (*Arachis hypogaea*) phytoalexin with prenylated benzenoid and but-2-enolide moieties. *J. Agric. Food Chem.*, **54**: 2111-5.

Williamson B, Tudzynski B, Tudzynski P, van Kan JA, 2007. Botrytis cinerea: the cause of grey mould disease. *Mol. Plant Pathol*., **8**: 561-580.