

Petunia Hybrid Shows Variation in Growth Due to Influence of Biotic and Abiotic Stress Components

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ABSTRACT

In natural environment, biotic and abiotic stress component influences the growth of plants. They always affect the development of plant in the different forms. Some plants have ability to encounter stresses by changing their morphological, physiological and biochemical activities. But some plant can't accommodate with these stresses and have negative impact due to reduction in photosynthetic activity, reduced transportation of water etc. Here, certain biotic and abiotic factors are applied to Petunia hybrida plant and then influence and reactions are studied for selected time period. Common garden Petunia- Petunia hybrida is derived from P.integrifolia and P.axillaris. Here, the applied factors are „wood ash extract“, „high temperature and light“, „temperate and cold water“ as abiotic factors and neem leaf extract and competition between plants as biotic factors.

Keywords :- Hybrida Plant, Petunia- Petunia Hybrida, Neem Leaf Extract, Biotic Factors

I. INTRODUCTION

Plants are the living organisms which perform different types of physiological activity such as photosynthesis, reproduction, respiration and other activities. Certain biotic and abiotic component influence on the plant development and growth. Sometimes the environment around the plant become adverse, it generate stress on plant and provides positive or negative impact on growth rate of plant(Calanca P.P., 2017). The occurrence of global warming and depleting green land, exhausted water resources, erratic rainfalls, expanding urbanization and climate induced abiotic stress lead to significant reduction in the production and growth of plants(Audil Gull et al., 2019).In this review, we

assess the importance, impact, and mitigation strategies of climate change driven interactions between biotic and abiotic stresses in plants.

Stress and Stress Response of the Plant:

“Stress in plant refers to external conditions that adversely affect growth, development or productivity of plant”. Stresses trigger a wide range of plant response like altered gene expression, cellular metabolism, change in growth rate, plant production etc. The plant can be recovered from injuries if the stresses are mild or of short term as the effect is temporary, while several stresses lead to death of plant. Such plants will be considered to be stress susceptible. However several plants like xerophytes can endure the stress. Environmental stresses can be

categorized into two types: Abiotic and Biotic Stress. Abiotic stress imposed on a plant by environment may be either physical or chemical. It is caused draught, high soil salinity, floods, extreme temperatures, high or low light level, acidic or alkaline soils, soils poor in nutrition etc. Most of the plants are sensitive to abiotic stress. While biotic stress exposed to plant by biological unit like disease, effect of other plant or organism, insect etc. Biotic stress in plant is caused by living organism.

Here, we take *Petunia hybrida* plant to apply some selected biotic and abiotic factors and observe effect of these stresses.

Systematic Position of *Petunia* hybrid according to Bentham & Hooker Kingdom: Plantae

Subkingdom: Phanerogams Class : Dicotyledons

Subclass: Gamopetalae Series: Bicarpellatae Order:

Polemoniales Family: Solanaceae

Genus: *Petunia*

Species: hybrid



III. MATERIALS AND METHODS

1. Neem Water Extract

The preparation of neem leaf extract was done by weighting 150 gm of fresh leaves, which is chopped into bites, then immersed in 1liter of water. The solution was stirred to allow proper leaching of the nutrient into the water and kept overnight. The

suspension was sieved to obtain clean neem leaf extract, which has light green colour. 150ml of neem leaf extract was poured into selected plant every day.



2. Competition between two plants:

We take two different plant of same family- Solanaceae: *Lycopersicum* and *Petunia*. Here, the amount of soil, amount of added water (150 ml) and size of pot is taken same as the other individual plant. It means the nutrient required for one plant is given to two plants. Hence here competition will be started between these two different plants of same family for nutrition. All species are not equally important but some are overtopping by their growth, reproduction etc. this overtopping plant modify the edaphic condition to control and affect the growth of other adjacent plant.



3. Ash Water

The wood ash was prepared from random wood pieces. Wood ash extract was prepared by 200gm of sieved wood ash added into 1 liter of water and stirred with rod to enhance proper leaching of nutrients. This solution is kept overnight and the suspension was properly sieved to obtain clear wood ash extracts, which has gray colour. 150ml of wood ash extract was poured into selected plant every day.



4. Exposure to high temperature and light:

200 watt Incandescent light lamp (tungsten filament bulb) is used to provide high temperature and light for approx. 5 hrs per day in two sessions. Lamp was kept at 30 cm away from plant. Everyday 150 ml tap water was poured.



5. Temperate Water:

Everyday temperate water (60-65 degree Celsius) was poured in selected plant. The amount of water is 150ml and also the amount of soil is same as other plants



6. Cold Water

Everyday cold water (5-10 degree Celsius) was poured in selected plant. The amount of water is 150ml and also the amount of soil is same as other plants.



IV.RESULTS AND DISCUSSION

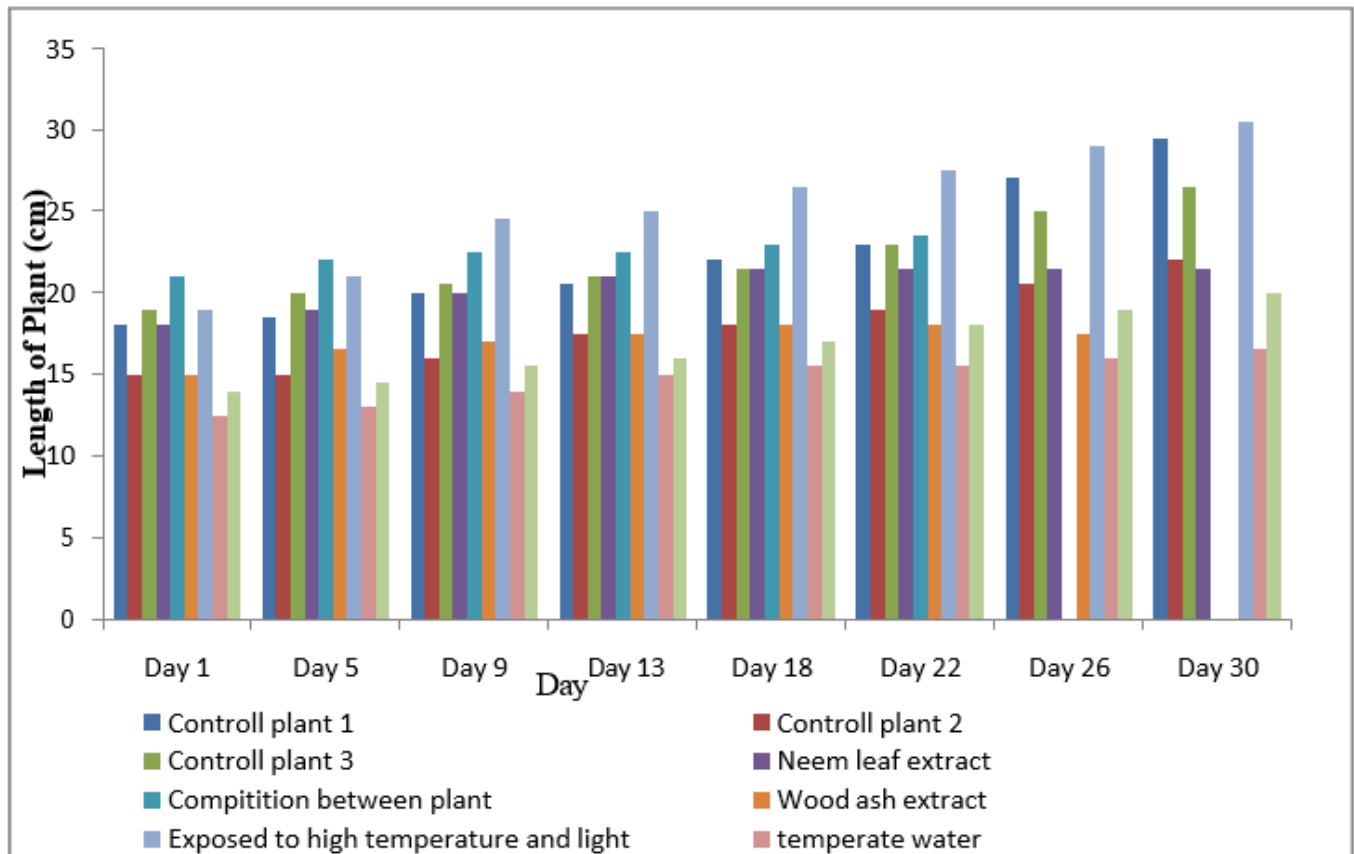


Figure 1. Graph showing length of the plant

At the interval of 4 days we measure the length of every plant. Observations and results suggest that the controlled plant 1, 2 and 3 which possess normal conditions shows continues increase in the length. Neem leaf extract treatment plant has increment in height initially but later shows stunted growth. It denotes that in initial few days the stress does not affect growth of plant but due to continues addition of neem leaf extract results in negative stress response of the plant. The plant grows with *Lycopersicum* shows constant growth but later the plant growth suppressed due to scarcity of nutrients. The wood ash extract treatment plant shows a little increment in length, however due to blockage of air spaces in the soil, the plant dried in the duration of one month. The plant treated with tungsten filament bulb shows high increment in plant length, which denotes positive phototropism of shoot system. The plant treated with temperate water (55-60 degree Celsius) does not show remarkable increment in length. The plant treated with cold water (5-10 degree Celsius) shows continues increment in length of the plant.

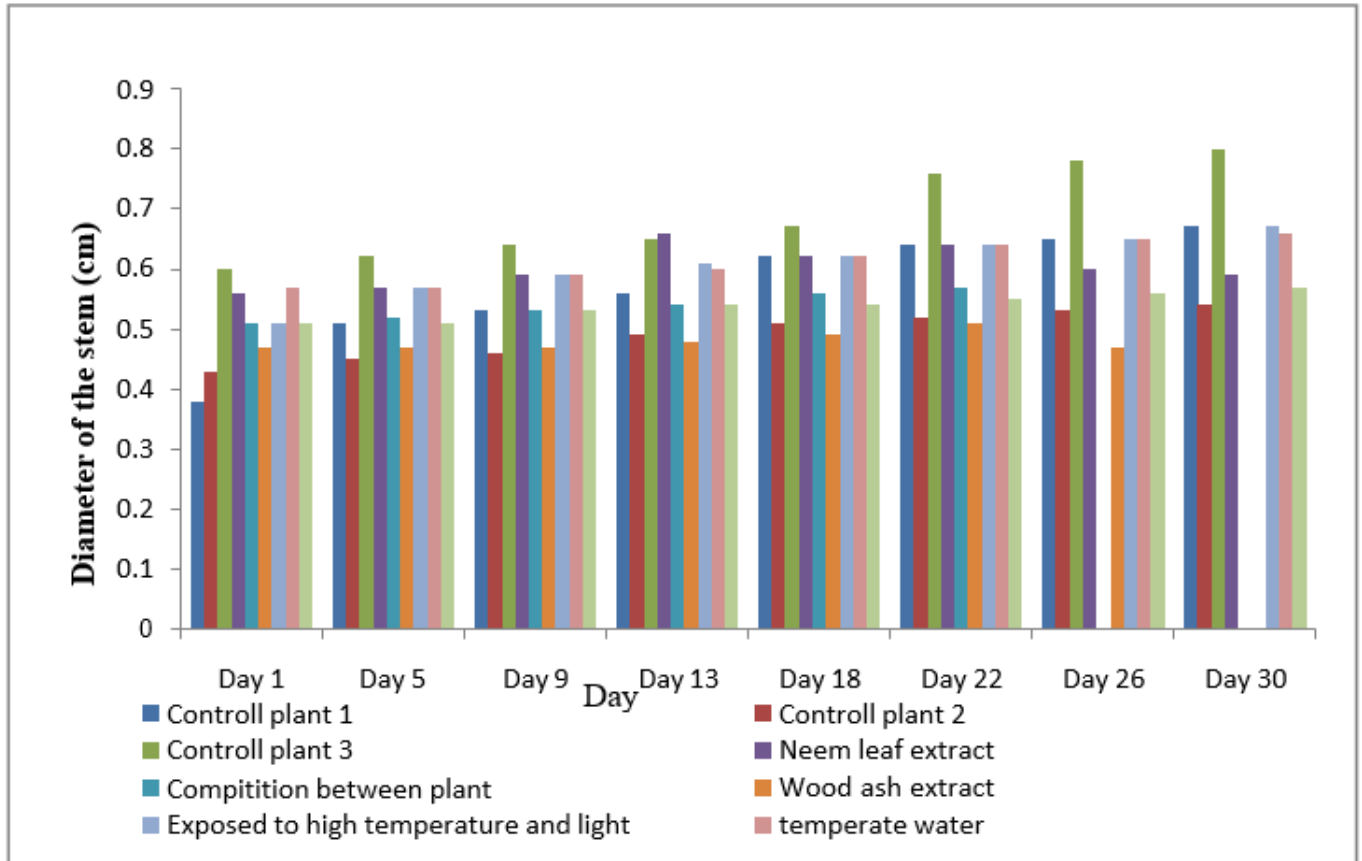


Figure 2. Graph showing diameter of stem

At the interval of 4 days we measure the diameter of every plant. Observations and results suggest that the controlled plant 1, 2 and 3 which possess normal conditions shows continues increase in the girth of the stem. Neem leaf extract treatment plant shows increment in diameter initially, but later shows stunted growth. It denotes that in initial few days the stress does not affect growth of plant but due to continues addition of neem leaf extract results in negative stress response of the plant. The plant grows with *Lycopersicum* shows constant growth but later the plant growth suppressed due to scarcity of nutrients. The wood ash extract treatment plant shows a little increment in stem girth, however due to blockage of air spaces in the soil, the plant dried in the duration of one month. The plant treated with tungsten filament bulb shows constant increment in stem girth. The plant treated with temperate water (55-60 degree Celsius) does not show remarkable increment in length girth of the stem. The plant treated with cold water (5-10 degree Celsius) shows continues slight increment in girth of the stem (Egli, D.B et al., 1980).

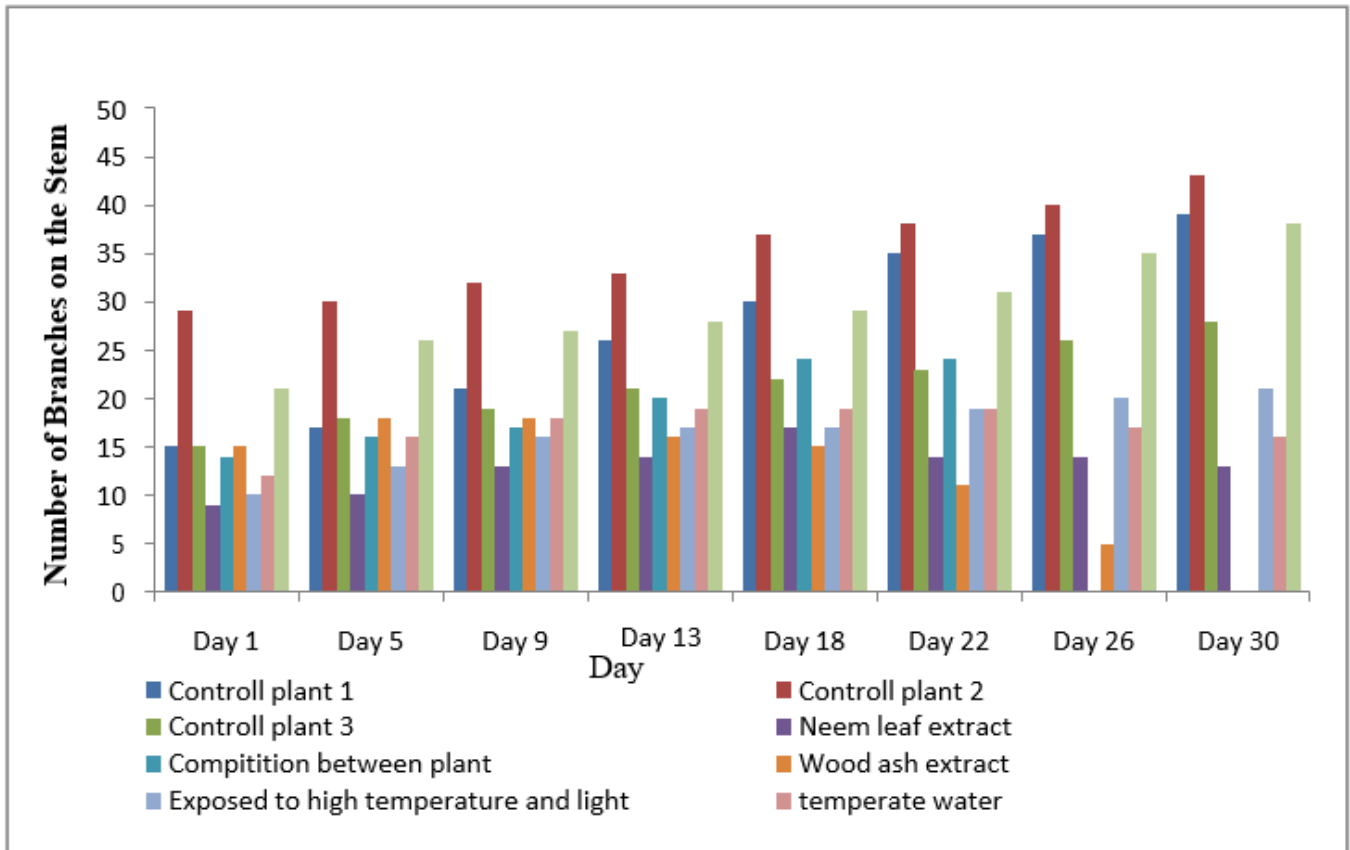


Figure 3. Graph showing number of branches

At the interval of 4 days we calculate the number of branches of every plant. Observations and results suggest that the controlled plant 1, 2 and 3 which possess normal conditions shows continuous increase in the number of branches on the stem. Neem leaf extract treatment plant shows increment in number of branch initially, but later shows stunted growth. It denotes that in initial few days the stress does not affect growth of plant but due to continuous addition of neem leaf extract results in negative stress response of the plant. The plant grows with *Lycopersicon* shows constant growth but later the plant growth suppressed due to scarcity of nutrients. The wood ash extract treatment plant shows a little increment in number of branches but later branches are decreased, but due to blockage of air spaces in the soil, the plant dried in the duration of one month. The plant treated with tungsten filament bulb shows constant increment in number of branches. The plant treated with temperate water (55-60 degree Celsius) shows initially increase in the number of branches later the small and growing branches dried, which leads to drop in number of branches. The plant treated with cold water (5-10 degree Celsius) shows continuous slight increment in number of branches.

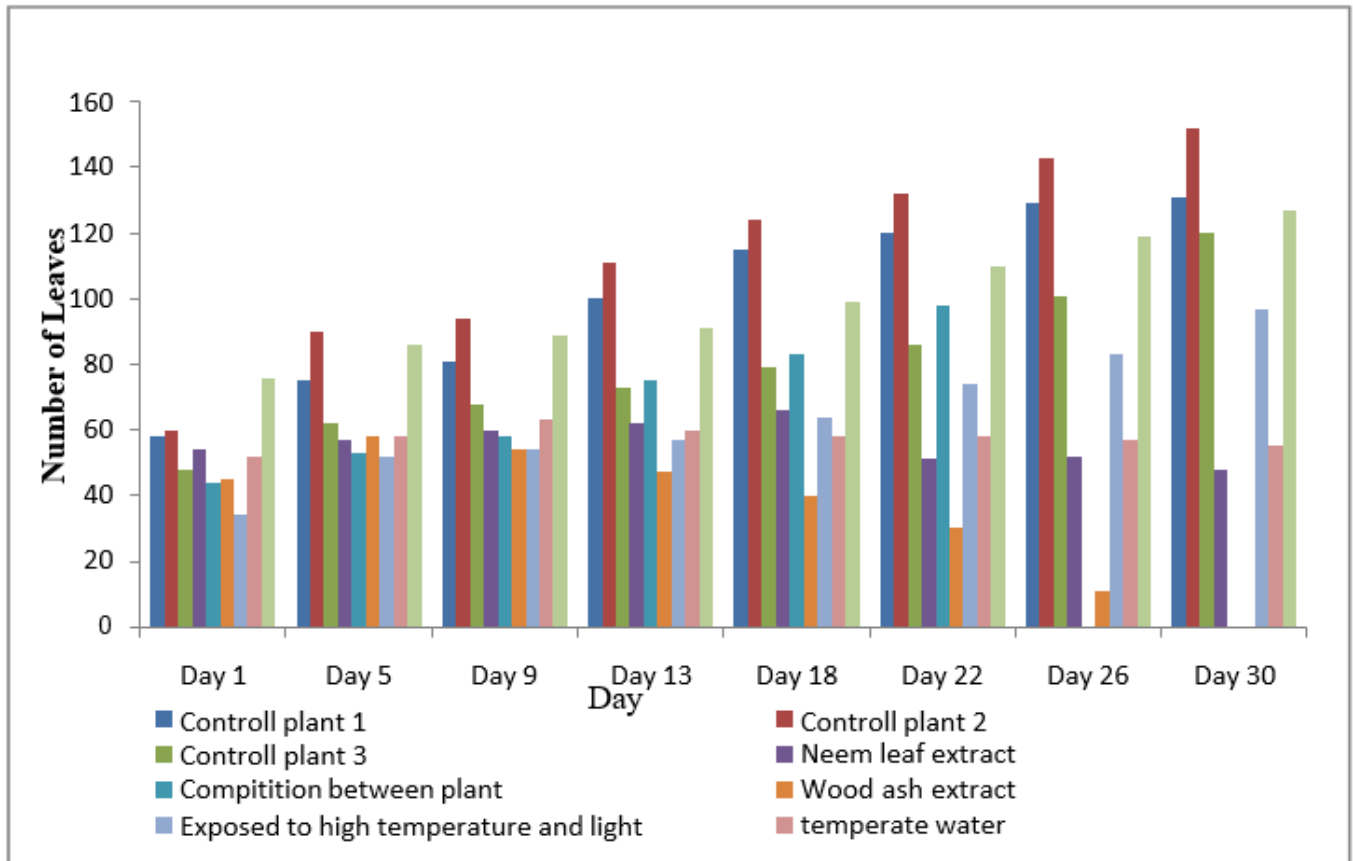


Figure 4. Graph showing number of leaves

Leaf development is strongly regulated by temperature. In *Arabidopsis*, the rate of leaf initiation, leaf expansion, and the duration of expansion increases linearly with temperature in the range of 6–26 °C (Granier et al., 2002). Similarly, at the interval of 4 days we calculate the number of leaves of every plant. Usually, for any plant the leaves fall off spontaneously; thus, the growth of a plant is as per the calculation of leaf means the rate of new growing leaf. Observations and results suggest that the controlled plant 1, 2 and 3 which possess normal conditions show continuous increase in the number of leaves on the stem. Neem leaf extract treatment plant shows increment in number of leaves initially, but later shows stunted growth and too many leaves fall off. It denotes that in initial few days the stress does not affect growth of plant but due to continuous addition of neem leaf extract results in negative stress response of the plant. The plant grown with *Lycopersicon* shows constant growth but later the plant growth is suppressed due to scarcity of nutrients. The wood ash extract treatment plant shows a little increment in number of leaves but later too many leaves were fallen off due to blockage of air spaces in the soil, the plant dried in the duration of one month. The plant treated with tungsten filament bulb shows constant increment in number of leaves. The plant treated with temperate water (55–60 degree Celsius) shows constant number of leaf later the number of leaves drop down. The plant treated with cold water (5–10 degree Celsius) shows continuous increment in number of leaves (Mahajan S, et al., 2005).

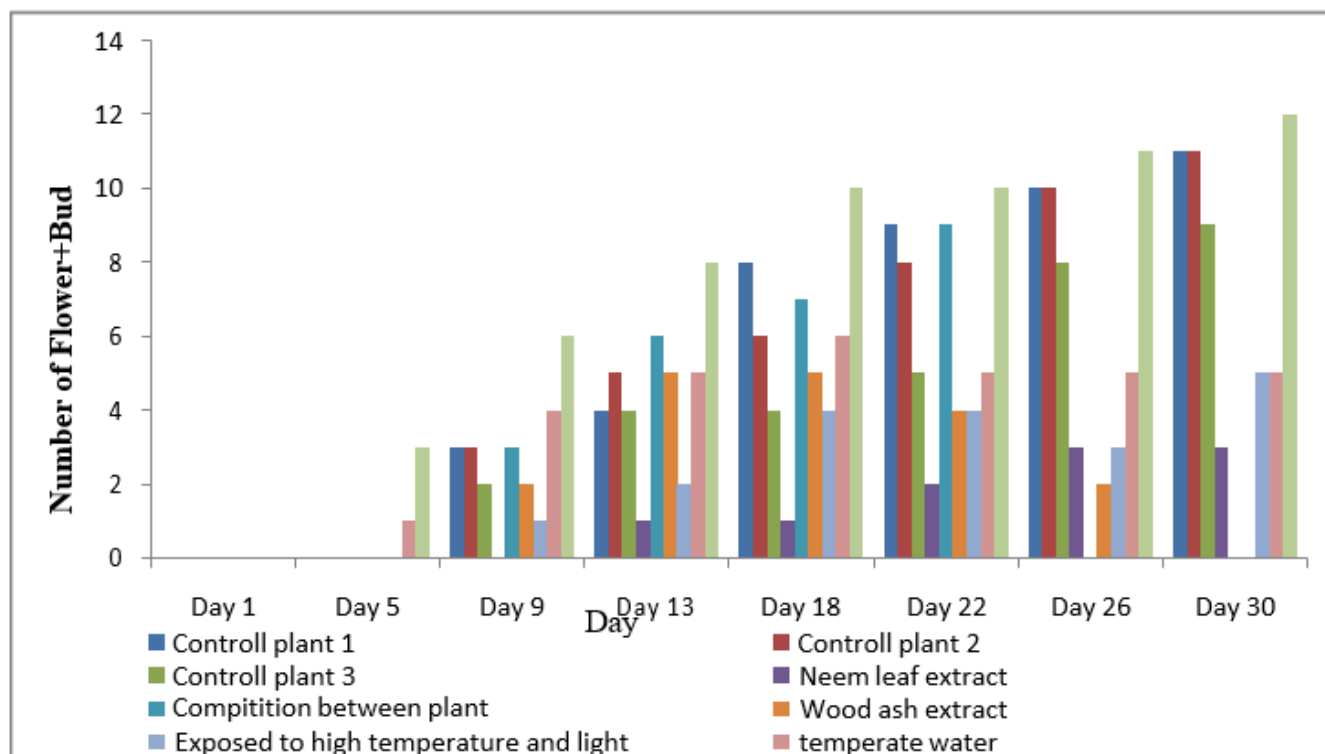


Figure 5. Graph showing flowering

At the interval of 4 days we calculate the number of buds and flowers every plant. Observations and results suggest that the controlled plant 1, 2 and 3 which possess normal conditions shows continuous increase in the number of buds and flowers on the stem. Neem leaf extract treatment plant shows increment in number of buds and flowers. The plant grows with *Lycopersicum* shows constant growth and number of buds and flowers increases initially but later the plant growth suppressed due to scarcity of nutrients. The wood ash extract treatment plant shows a little increment in number of buds and flowers but later buds and flowers are decreased due to blockage of air spaces in the soil, the plant dried in the duration of one month. The plant treated with tungsten filament bulb shows constant increment in number of buds and flowers but it is not continuous. The plant treated with temperate water (55-60 degree Celsius) shows initially increase in the number of buds and flowers later the small and growing buds dried, which leads to drop in number of buds and flowers. The plant treated with cold water (5- 10 degree Celsius) shows continuous major increment in number of branches. The cold water brings early and rapid flowering in the plant.

V. CONCLUSION

Climate change will alter plant development in ways that will have significant impacts on the function of crop plants and plants in natural ecosystems. Future growing conditions will bring increased temperature, increased frequency of extreme events including heatwaves and drought events, and changes in the composition of the atmosphere (IPCC, 2014). Here, we applied some

biotic and abiotic factors to *Petunia hybrida* plant and different effects are observed. We found that the moderate amount of neem leaf extract is not harmful for the plant but, excess amount leads to stunted growth of the plant. With plant of same family- *Lycopersicum*, *Petunia hybrida* shows negative impact. *Lycopersicum* controls the growth of *Petunia hybrida* and change the edaphic condition beneficial to its own growth. It proves that in competition *Lycopersicum* is overtopping species then *Petunia*

hybrida. Treatment of wood ash extract gives negative impact on the plant and leads to death of the plant. Due to tungsten filament lamp the length of stem increase rapidly which denote positive phototropism of shoot system. But due to high temperature the nearby plant parts are damage.

Temperate water is not suitable to for *Petunia hybrida*. It gives negative effect for plant growth. Cold water give positive impact to *Petunia hybrida* like early flowering, increase in number of flowers, leaf etc than the controlled plant. Thus, if we know the effect of particular stress on selected plant, then we could able to receive desirable product or response from the plant. Which helpful for increasing plant productivity.

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