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Research Article

GROWTH, REPRODUCTION AND PHOTOSYNTHESIS OF *PARTHENIUM HYSTEROPHORUS*

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ABSTRACT
Growth and reproduction potential with respect to season and photosynthetic gas exchange behavior under elevated (*i.e.*, short term) CO2 at varying temperature, relative humidity (RH), and irradiance level were investigated in *Parthenium hysterophorus* Linn. Lower values of biomass, relative growth rate , net assimilation rate, crop growth rate, leaf area duration, leaf area index and number of flowers and seeds in winter compared with summer showed that *Parthenium hysterophorus* is greatly suppressed by low temperature during winter. This was due to constrained vegetative growth, seedling emergence and seed to flower ratio. This species showed maximum photosynthetic response to temperature at 25 to 35˚c, and the net photosynthetic rate was reduced considerably at a low temperature (7˚C)

Keywords*: Growth and Reproductive Potential, Humidity, Irradiance Temperature, Net Photosynthesis*

INTRODUCTION
Parthenium hysterophorus (family: Asteraceae) is an aggressive wild, annual herb, with worldwide occurrence (Towers *et al.*, 1977). It threatens human and animal health through its prolific growth, copious pollen and seed production which contains toxic allelochemicals (Das and Das, 1995 : Pandey 1996). It causes allergic contact dermatitis and respiratory problems among sensitive humans. The weed may cause toxicity, sometimes even death, when consumed by animals especially during summer, when green forage is scarce. Thus, it has tremendous socioeconomic implications, affecting human life in various ways.
In India the species continue to spread through human activities (Aneja *et al.*, 1991). It is seed – propagated and is capable of completing several life cycles in a year. It infests almost all field crops pastures and abandoned land (*i.e.*, fallow fields). *Parthenium hysterophorus* has been reported to be a C_3 – C_4 intermediate, with leaves on top having C_3 mesophyll with non – kranz leaf anatomy and leaves at the middle and base having C_4 mesophyll, with kranz leaf anatomy (Rajendrudu and Rama Das, 1990) . Thus, it exhibits features intermediate between C_3 and C_4 plants.
The present investigation was designed to study growth and reproductive performance of *Parthenium hysterophorus* with respect to seasons and photosynthetic gas exchange behaviour at different levels of CO_2, temperature, light and relative humidity.

MATERIALS AND METHODS
Climate: Meteorological data were collected from study site.
Plant materials: *Parthenium* seeds were collected and sown in nursery beds and pots. Actually nursery stands facilitated both growth and photosynthetic gas exchange studies and pots facilitated the gas exchange studies at higher temperature because the plants could be easily moved to a polyhouse with appropriate temperature control . Growth and photosynthetic response remain same in both media.
Methods: Flower production was monitored in 10 representative plants. Seeds production was calculated by multiplying number of flowers per capitulum. Gas exchange was measured on 10 single fully grown leaves on each of 10 well – watered plants in the pots in the nursery beds. Gas exchange was measured on fully grown leaves between the 5^{th} node down from the tip and 5^{th} node above the stem base. Effect of co_2, temperature, photosynthetic photon flux (ppf), and RH on net photosynthesis and related parameters (eg.

Stomatal) conductance, internal co_2 concentration, transpiration and water use efficiency [WUE] of *Parthenium hysterophorus* were measured.

Table 1: Showing relative growth characteristics of *Parthenium hysterophorus* during summer and winter seasons

Growth characteristics	***Summer***	***Winter***
Leaf area index	5.64	3.38
Relative growth rate	0.080	0.053
Net assimilatory rate	4.768	0.550
Crop growth rate	15.72	1.51
Leaf – area duration	259.5	157.1
Plant height	1.779 m	0.148 m
Biomass production	1.414 kg	0.136 kg
Flowers (in thousands)	42.956	0.365
Seeds (in thousands)	147.965	0.365

RESULTS AND DISCUSSIONS

The effect of light and temperature on leaf net photosynthesis and transpiration at ambient CO_2 concentration and 30% RH were shown in table. Net photosynthesis increased with increasing PPF from 10 to 500 µ mol at 47˚c, where maximum net photosynthesis occurred at 1000µ mol . Though both high and low temperature were inhibitory to *Parthenium hysterophorus* the overall rate of net photosynthesis, was lowest at highest temperature (*i.e.,* 47˚C)

Thus, the present finding show that *Parthenium hysterophorus* may perform better with global temperature end atmospheric co_2 increase. However, higher temperature drive increased transpiration, especially during warmer summer days and may (depending on the temperature) reduce its invasiveness or even threaten survival. Increased invasiveness of the species due to atmospheric CO_2 and temperature rise may cease when the temperature rises beyond an undefined limit during the warmer days as this may cause an increase in transpiration, threatening the survival of the species.

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