Growth Study of *Achyranthes aspera* Linn. Under the Impact of Industrial Effluents

***Kavita Tyagi[1], Sandhya Sharma [2], Rajat Rashmi [3] and Sadia Ayub[4]**

[1]National Medicinal Plants Board (Deptt. of AYUSH, Ministry of Health & Family Welfare, Govt. of India), Chandralok Building, 36 Janpath, New Delhi- 110001.

[2]Department of Botany, M.M.H.College, Ghaziabad – 201001, India.

[3]Homoeopathic Pharmacopoeia Lab. (Ministry of Health and Family Welfare, Govt. of India), PLIM Building, Ghaziabad 201001, U.P.

[4]Central Council for Research in Unani Medicine, 61-65 Institutional Area, Janakpuri, New Delhi-110058

Abstract

The Industrial scenario of Ghaziabad in Western UP on the eastern side of river Yamuna and nearby Hindon River is posing serious concern to the environment. In the vicinity of industries, many important plants are found growing which are medicinally important. The effluents of industries have not only changed the morphology of plants but also their therapeutic properties. Therefore, an attempt has been made for comparative growth study of *Achyranthes aspera* Linn. under the impact of industrial effluents from three industries. The plant commonly known as Latjira, belongs to family Amaranthaceae, is a 1-3 m high, stiff, erect herb, commonly found as a weed throughout India upto 3000 ft. It is much valued in indigenous medicine. This is an important plant of Siddha and Ayurveda. For this investigation, three major industrial sites of Ghaziabad viz. Atlas Cycle Industry, Ester -India Chemicals and Magnum Paper Mill and apparently non polluted areas of villages Bayana and Dasana in district Ghaziabad, U.P. and ALTT Centre, Ghaziabad were selected.

In this study various growth parameters like height of plants, shoot length, root length and number of leaves/ plant were observed in industrial and controlled area. Results show a mark reduction in all the growth parameters studied but plants respond differentially in different industrial effluents.

Key Words : Growth parameters, *Achyranthe aspera*, Effluent analysis.

Introduction

A survey of Ghaziabad district indicates that most of the industries are situated close to the populated area and agricultural land. The industrial wastes are being discharged in the nearby rivers and streams through the discharged channels of factories, inspite of Pollution Control Acts in practice. The pollution in the region has mercilessly affected the growth of various plant species having substantial medicinal value.

The industrialization has adversely affected the growth and quality of medicinal plants. Therefore, an attempt has been made to undertake the study on impact of industrial pollution on the growth of *Achyranthes aspera* Linn., a medicinal plant abundantly growing in the polluted areas of Sahibabad, Trans Hindon Industrial areas and non-polluted areas of villages Bayana and Dasana in district Ghaziabad, U.P. and ALTT Centre, Ghaziabad. The plant is used as one of the ingredients in the “Siddha” preparation of “Naaga Parpam” and

*Author for correspondence

"Naaga Chendooram". Seeds contain mainly saponin a and b, hentriacontane, alkaloid, oleanolic acid, saponin and achyranthine. Plant is a pungent and laxative and used in piles, boils eruptions of the skin *etc* (Joshi, 2000). In this study various growth parameters like height of plants, shoot length, root length and number of leaves/ plant have been studied in industrial and controlled areas and observations recorded.

Materials and Methods

Monthly visits were made to Sahibabad industrial area (polluted area) for one year (2002-2003) where Magnum Paper Mill Industry, Atlas Cycle Industry and Ester - India Chemicals are located. Village Bayana and Dasana in Distt. Ghaziabad, U.P. and ALTT Centre were taken as non polluted areas for study of *Achyranthes aspera*. Plants of same height and age (approx.) were selected from both the sites. The non–polluted areas of the present study were 3-4 km away from the industrial area. Meteorology and soil conditions of both the areas are similar. The plants were observed every month for one to two years from the area near sites and to study the effect of industrial effluent. The length of plant, root and shoot length, number of leaves per plant, leaf size, petiole size, lamina size etc. were studied.

The standard methods of APHA (1981) and Trivedi and Goel (1986) were followed for different analysis of effluents of the selected industries.

Results and Discussion

Analysis of effluents : Table 1 shows analysis of effluents differ significantly from each other in their colour, pH and generally having appreciably high total solids, total dissolved solids, suspended solids, BOD, COD, total heavy metal contents and organic matters. Magnum Paper Mill Industry effluents have the highest values for pH, odour, total solids, total dissolved solids, suspended solids, BOD, COD, while Atlas Cycle Industry effluent possess highest amount of heavy metals and Ester -India Chemicals contains some organic matters.

Growth studies: The various growth parameters such as height of plants (shoot, root length) and number of leaves/ plants were studied in industrial and non-polluted areas (**Fig. 1-3**). Results show a mark reduction in all the growth parameters studied but plant respond differentially in different industrial effluents. However, there are no major changes in the growth of root and shoot length of plants during the month of October to December at both sites. The results are tabulated in **table 2, 3 and 4.**

Studied growth parameters such as shoot length, root length and number of leaves / plants were decreased in all the plant samples collected from polluted areas. The results obtained in the present study indicated that the pollutants which were emerging out with industrial effluents cause a serious problem to other nearby growing medicinally important plants. In a similar study, Gupta (1981) reported that *Solanum melongena* which was affected badly by the air pollutants in the vicinity of the power plant complex resulted in poor growth and reduced productive capacity. The studies of Mhatre (1980), Asthana (1988) are also in agreement with present findings. Srivastava and Renu (1988) analyzed the physico–chemical and biological characteristics of sugar factory effluent. They found that these effluents not only endanger the existence of aquatic life but also decrease the productive potential of natural water bodies and make water unfit for irrigation, bathing and drinking.

The plants growing in the vicinity of polluted water released by Paper Mill were actually under stress and have not shown any visible symptoms of injury but there are certain invisible symptoms which were measurable in terms of their various growth parameters. The growth study of *Achyranthes aspera* Linn. in the present investigation is in agreement with Pande and Rao (1978); Ghouse and Khan (1984); Salgare and Andhyrarujina (1987, 1988); Gawde (1988); Tripathy and Sahu (1997) and Salgare and Acharekar (2000).

Conclusion

The present study showed that the effluent of all the three selected industries adversely affects the growth of the plants. So it can be suggested that the effluent of these industries should not be used for irrigation at any dilution. Further, the medicinal plants, which are growing in the vicinity of these industries, should not be used for the preparation of medicines, and effluents should be properly treated or recycled before their disposal.

Table-1: Growth parameters of *Achyranthes aspera* Linn. observed under the influence of Magnum Paper Mill Effluent.

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
1.	Jan.	6.77 + 0.74 CV = 10.93	4.94 + 0.98 CV = 1.99	3.99+ 0.49 CV = 12.56	3.10 + 0.46*** CV = 15.33	51.00 + 0.08 CV = 1.56	19.00 + 0.66** CV = 3.47
2.	Feb.	6.98 + 0.36 CV = 5.15	5.34 + 0.22** CV = 4.11	4.89 + 0.68 CV = 13.91	3.68 + 0.79 CV = 21.46	58.00+ 0.75 CV = 1.29	17.2 + 1.80*** CV = 6.26

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
3.	Mar.	7.72 + 0.48 CV = 6.21	5.39 + 0.38** CV = 7.05	5.31 + 0.39 CV = 7.34	4.31 + 0.29*** CV = 6.72	63.80 + 0.45 CV = 0.79	52.60 + 0.75* CV = 1.42
4.	Apr.	8.19 + 0.11 CV = 1.34	6.12 + 0.98*** CV = 1.60	6.89 + 0.45 CV = 6.53	5.89 + 0.38*** CV = 5.10	68.00 + 0.77 CV = 1.13	54.00 + 0.76* CV = 1.40
5.	May	7.68 + 0.38 CV = 4.94	6.89 + 0.29 CV = 4.21	7.89 + 0.39 CV = 4.94	5.12 + 0.30* CV = 5.85	67.20 + 0.27 CV = 0.40	64.00 + 0.93 CV = 1.43
6.	Jun.	8.83 + 1.35 CV = 15.28	7.63 + 1.89 CV = 24.86	8.02 +s 0.32 CV = 3.99	7.39 + 0.40 CV = 5.41	72.80 + 35.66 CV = 0.91	69.00 + 0.12 CV = 0.17
7.	Jul.	9.39 + 1.80 CV = 19.17	8.03 + 1.39 CV = 17.31	8.92 + 0.49 CV = 5.55	7.99 + 0.29 CV = 3.62	83.80+ 0.10 CV = 0.12	70.00 + 0.50* CV = 0.71
8.	Aug.	13.77 + 0.54 CV = 3.19	11.94 + 0.18*** CV = 1.50	9.60 + 0.49 CV = 5.10	8.50 + 0.86 CV = 10.11	95.00 + 0.33 CV = 0.35	75.00 + 0.60* CV = 0.80
9.	Sept.	19.70 + 0.81 CV = 4.12	11.61 + 0.68* CV = 0.58	15.00 + 1.09 CV = 0.93	10.5 +0 .50*** CV = 14.28	80.00 + 0.14 CV = 0.18	78.40 + 0.50 CV = 0.64
10.	Oct.	20.80 + 0.86 CV = 4.13	11.71+ 0.92* CV = 7.92	20.50 + 0.63 CV = 3.07	17.50 + .80*** CV = 4.57	132.80+0.18 CV = 0.14	99.40 + 0.31* CV = 0.32
11.	Nov.	21.80 + 1.93 CV = 8.86	13.68 +0.63*** CV = 4.60	23.12 + 0.89 CV = 3.84	18.86+ 0.92*** CV = 4.93	212.7 + 1.62 CV = 0.76	122.60 + 1.93* CV = 1.57
12.	Dec.	22.5 + 0.98 CV = 4.35	14.76 + 0.39** CV = 2.64	25.39 + 0.38 CV = 1.49	20.83 + 0.80** CV = 3.84	210.0 + 1.69 CV = 0.80	109.0 + 1.87 CV = 1.77

Significant at 0.1% --*; 1.0% -- **; 5.0% -- ***

Table-2: Growth parameters of *Achyranthes aspera* Linn. observed under the influence of Atlas Cycle Industry Effluent.

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
1.	Jan.	6.72 + 0.73 CV = 10.86	4.91+ 0.21 CV = 4.27	4.99+ 0.29 CV = 5.81	4.10 + 0.56*** CV = 13.65	48.00 + 0.09 CV = 0.18	18.00 + 0.76** CV = 4.22

Sl. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
2.	Feb.	6.80 + 0.36 CV = 5.29	5.24 + 0.22** CV = 4.19	5.50 + 0.68 CV = 12.36	3.25 + 0.69 CV = 21.23	52.00+ 0.71 CV = 1.36	16.15 + 1.90*** CV = 11.76
3.	Mar.	7.22 + 0.48 CV = 6.64	5.19 + 0.28** CV = 5.39	6.00 + 0.39 CV = 6.5	4.31 + 0.29*** CV = 6.72	63.80 + 0.45 CV = 0.70	52.60 + 0.75* CV = 1.42
4.	Apr.	8.19 + 0.11 CV = 1.34	6.12 + 0.28*** CV = 4.57	6.22 + 0.15 CV = 2.41	5.39 + 0.38*** CV = 7.05	61.00 + 0.97 CV = 1.59	51.00 + 0.26* CV = 0.51
5.	May	6.16 + 0.18 CV = 2.92	5.29 + 0.19 CV = 3.59	6.82+ 0.19 CV = 2.78	5.45 + 0.40* CV = 7.33	62.20 + 0.27 CV = 0.43	54.00 + 0.13 CV = 0.24
6.	Jun.	8.63 + 1.35 CV = 15.64	7.23 + 1.89 CV = 26.14	7.02 + 0.32 CV = 4.55	6.09 + 0.20 CV = 3.28	68.20 + 5.66 CV = 8.30	62.00 + 0.22 CV = 0.35
7.	Jul.	9.29 + 1.80 CV = 19.37	8.13 + 1.29 CV = 15.86	8.12 + 0.59 CV = 7.26	7.20 + 0.29 CV = 4.02	72.80+ 0.30 CV = 0.41	70.00 + 0.25* CV = 0.35
8.	Aug.	12.97 + 0.24 CV = 1.85	10.2 + 0.24*** CV = 2.34	9.25 + 0.49 CV = 5.29	7.95 + 0.86 CV = 10.81	85.00 + 0.33 CV = 0.39	76.00 + 0.65* CV = 0.85
9.	Sept.	17.20 + 0.81 CV = 4.71	12.61 + 0.62* CV = 4.96	14.00 + 1.09 CV = 7.78	12.5 + 1.56*** CV = 12.48	83.00 + 0.14 CV = 0.16	75.40 + 0.50 CV = 0.66
10.	Oct.	19.20 + 0.86 CV = 4.47	10.96+ 0.92* CV = 8.39	21.50 + 0.63 CV = 2.93	16.2 + 0.80*** CV = 4.93	126.8 + 0.18 CV = 0.14	102.40 + 0.31* CV = 0.30
11.	Nov.	21.80 + 1.93 CV = 8.85	13.68+ 0.63*** CV = 4.60	23.12 + 0.89 CV = 3.85	18.8+ 0.92*** CV = 4.87	201.2 + 1.62 CV = 0.81	100.60 + 1.23* CV = 1.22
12.	Dec.	23.5 + 0.98 CV = 4.17	15.76 + 0.39** CV = 2.47	23.39 + 0.38 CV = 1.62	19.83 + 0.80** CV = 4.03	209.0 + 1.29 CV = 0.62	106.0 + 1.65 CV = 1.56

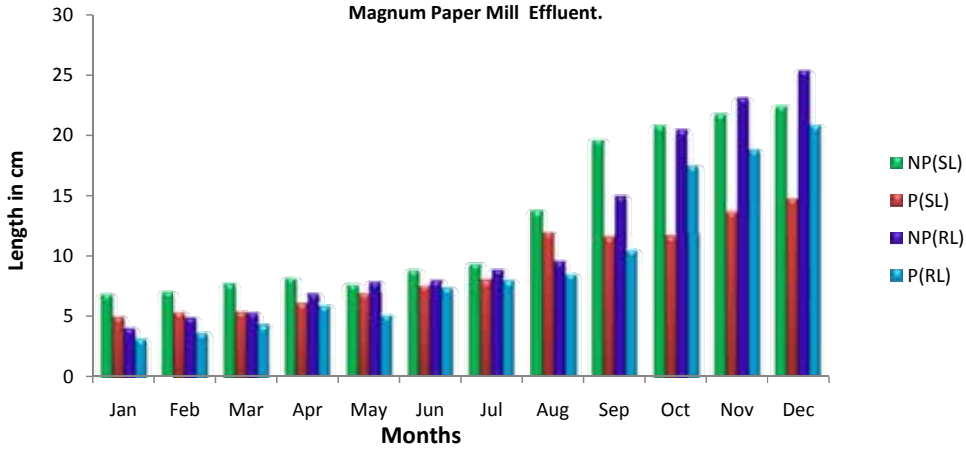
Significant at 0.1% -- * ; 1.0% -- ** ; 5.0% -- ***

Table-3: Growth parameters of *Achyranthes aspera* Linn. observed under the influence of Ester India Chemicals Effluent.

S. No.	Para.	Shoot Length (cm)		Root Length (cm.)		No. of Leaves/ Plant	
	Mon.	NP	P	NP	P	NP	P
1.	Jan.	7.72 + 0.73 CV = 9.45	4.25+ 0.40 CV = 9.41	4.59 + 0.68 CV = 14.81	4.00 + 0.56*** CV = 14.00	48.00 + 0.09 CV = 0.18	17.00 + 0.56** CV = 3.29
2.	Feb.	7.80 + 0.36 CV = 4.61	5.15 + 0.12** CV = 2.33	5.31 + 0.39 CV = 7.34	4.22 + 0.69 CV = 16.35	52.00+ 0.71 CV = 1.36	16.3 + 1.50*** CV = 9.17
3.	Mar.	8.02 + 0.48 CV = 5.98	4.59 + 0.38** CV = 8.27	5.99+ 0.29 CV = 4.84	4.26 + 0.29*** CV = 6.80	63.80 + 0.45 CV = 0.70	50.60 + 0.65* CV = 1.28
4.	Apr.	8.29 + 0.11 CV = 1.32	6.10 + 0.38*** CV = 6.22	6.22 + 0.45 CV = 7.23	4.29 + 0.48*** CV = 11.18	61.00 + 0.97 CV = 1.59	50.00 + 0.16* CV = 0.32
5.	May	7.26 + 0.38 CV = 5.23	5.09 + 0.49 CV = 9.62	6.82+ 0.49 CV = 7.18	5.00 + 0.60* CV = 12.00	62.20 + 0.27 CV = 0.43	52.00 + 0.23 CV = 0.44
6.	Jun.	8.93 + 1.35 CV = 15.11	6.10 + 1.89 CV = 30.98	7.02 + 0.32 CV = 4.55	6.00 + 0.50 CV = 8.33	68.20 + 5.66 CV = 8.29	61.00 + 0.25 CV = 0.40
7.	Jul.	9.29 + 1.80 CV = 19.37	7.12 + 1.29 CV = 18.11	8.12 + 0.59 CV = 7.26	7.10 + 0.28 CV = 3.94	72.80+ 0.20 CV = 0.27	69.00 + 0.15* CV = 0.21
8.	Aug.	12.87 + 0.24 CV = 1.86	9.24 + 0.24*** CV = 2.59	9.25 + 0.49 CV = 5.29	7.55 + 0.26 CV = 3.44	85.00 + 0.33 CV = 0.38	71.00 + 0.35* CV = 0.49
9.	Sept.	17.30 + 0.81 CV = 4.68	10.51 + 0.52* CV = 4.94	14.00 + 1.09 CV = 7.78	11.5+ 1.56*** CV = 13.56	83.00 + 0.14 CV = 0.16	73.40 + 0.30 CV = 0.40
10.	Oct.	19.20 + 0.86 CV = 4.47	10.86+ 0.62* CV = 5.70	21.50 + 0.63 CV = 2.93	15.20+ 0.8*** CV = 5.26	126.8 + 0.18 CV = 0.14	95.40 + 0.41* CV = 0.42
11.	Nov.	22.80 + 1.93 CV = 8.46	12.60+ 0.53*** CV = 4.20	23.12 + 0.89 CV = 3.84	16.8+ 0.91*** CV = 5.39	201.20+ 1.6 CV = 0.80	98.60 + 1.25* CV = 1.26
12.	Dec.	24.5 + 0.98 CV = 4.00	13.76 + 0.29** CV = 2.10	23.39 + 0.38 CV = 1.62	17.82 + 0.90** CV = 5.05	209.0 + 1.29 CV = 0.61	103.0 + 1.36 CV = 1.32

Significant at 0.1% -- * ; 1.0% -- ** ; 5.0% -- ***

Figure 1: Growth studies of *Achyranthes aspera* Linn. observed under the influence of Magnum Paper Mill Effluent.



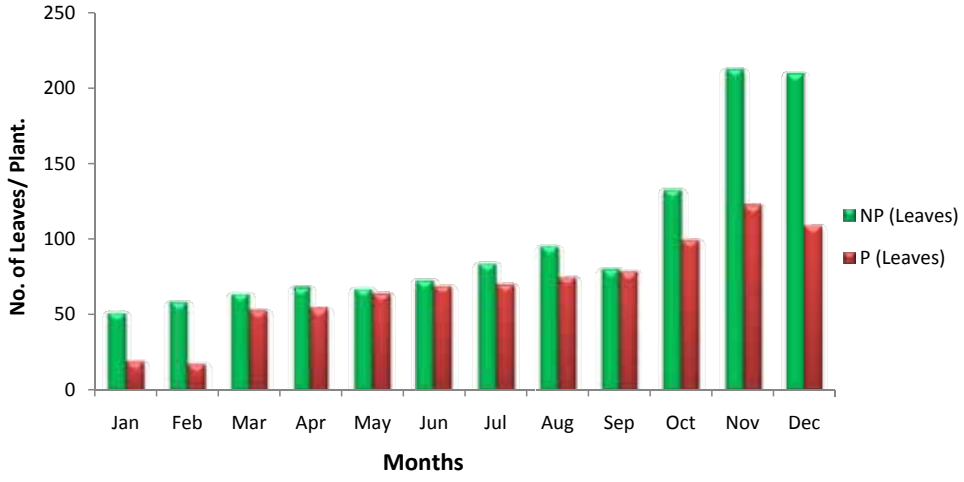
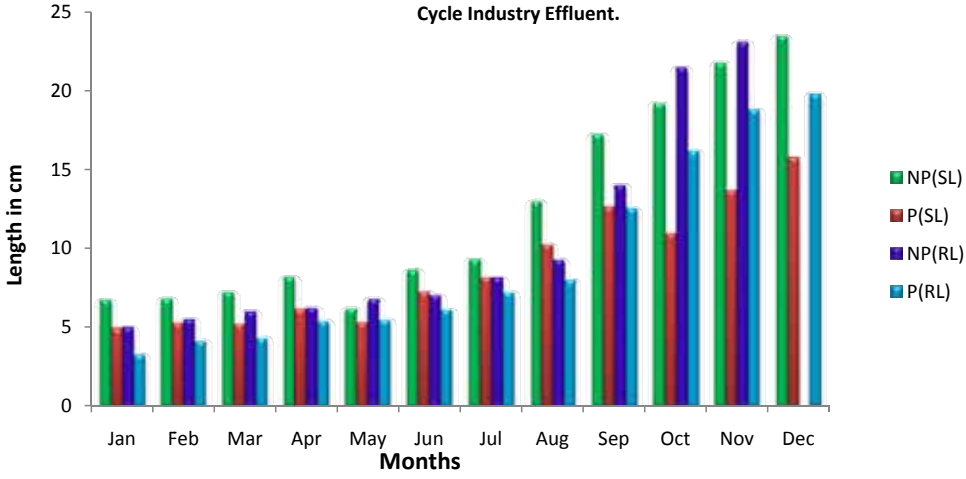


Figure 2: Growth studies of *Achyranthes aspera* Linn. observed under the influence of Atlas Cycle Industry Effluent.



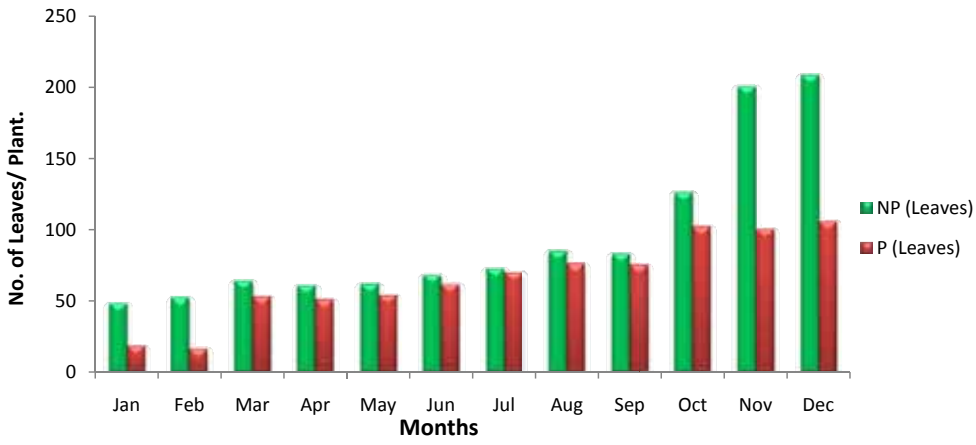
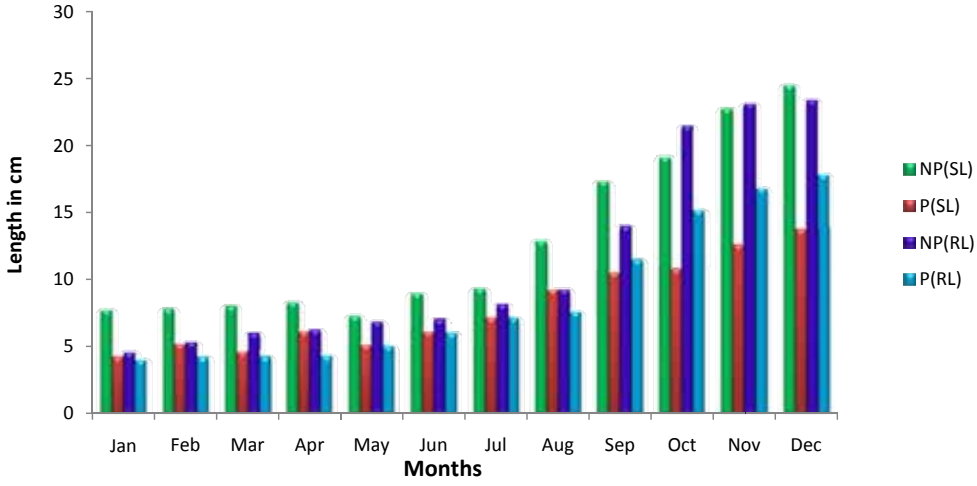
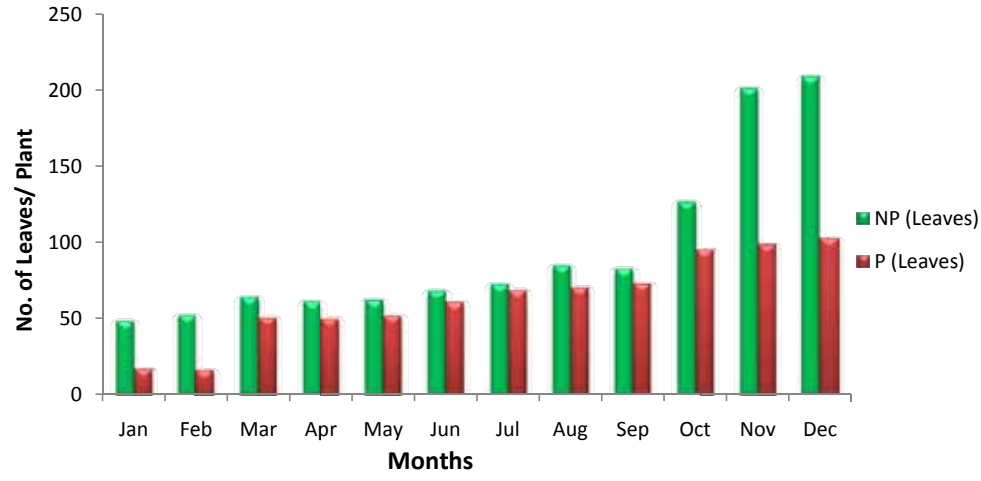


Figure 3: Growth studies of *Achyranthes aspera* Linn. observed under the influence of Ester India Chemicals Effluent.





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