Phytotoxic effect of *Andrographis paniculata* nees *on* metabolism of *Parthenium hysterophorus L.*

T.G. Nagaraja and S.M. Deshmukh

ABSTRACT

The powdered leaves, stem and roots of *Andrographis paniculata* Nees adversely affected the metabolism of *Parthenium hysterophorus* L upto 60 DAS. It influenced plant height, leaves number and seeds per plant. The total sugars and lipid contents were decreased in leaves, stem and roots of *Pathenium hysterophorus* L supplied with *Andrographis paniculata* Nees residues. While total chlorophylls, polyphenols, total aminoacids and protein contents were greatly reduced as compared to control. The residues of *Pathenium hysterophorus* L may be used as a potent bioherbicide.

Key words: Amino acids, *Andrographis paniculata Nees, Parthenium hysterophorus*, carbohydrates, lipid and proteins

INTRODUCTION

Parthenium hysterophorus L (Asteraceae) an annual herbaceous weed, is endemic to the Americas but is now widely spread in India and other countries. It is wide spread in grassland, fruit tree, orchards and arable land in neutral and acidic soils. In India the weed is considered to be a major problem (Gupta and Sharma, 1977), because,it has a high rate of fecundity efficient seed dispersal and adaptability to grow under adverse environmental conditions. Its reproductive abilities have helped this exotic weed to dominate the invaded area.

P. hyslerophorus cause allergic skin diseases, asthma in human beings, due to presence of its allelopathic effect (Das and Das, 1995). The allelopathic potential of *Parthenium* weed results from release of phytotoxic substances such as ferulic, I chlorogenic, p-coumaric and p-hydrohenzoic acids, parthenin, amhrasin and coronopilin, which inhibit the germination growth .of several crop plants and multipurpose trees (Basak, 1984) and also cause allergic dermatitis and asthma in human beings (Auld and Medd, 1987). It is problematic weed in Indian agricultural productivity. At present it is controlled by mechanical and use of herbicide. The use of herbicides created hazards on our ecosystem. Hence, an interest created to study an alternative eco-friendly approach to control *Parthenium.* Thus the concept of allelopathetic utilized to control *P. hysterophorus.*

Andrographis panieulata Nees known as King of Bitter (Acanthaceae), an annual branched glabrous herb, common among undergrowths in forest areas in western ghats of India known as Kirata or Kalmagha. It is extensively used as a medicinal plant in India, China and Thailand (Sandberg, 1994). It possess abortifacient, acrid, analgesic, anti inflammatory, anti bacterial, anti-periodic, choleratic, depurative, digestive, expectorant, hepatoprotective hypoglycemic, laxative, sedative properties. Hence, it is a domestic medicine for flatulence, and diarrhea of children in India. The leaves contain the highest amount of andrographolide the most medicinally active phytochemical in plant. While seed contain lowest andrographolide (Sharma *et al.*, 1992). It is the chief constituents of an Ayurvedic drug S.G. 1 "Switraadilepa" for dermatological diseases. Therefore, an attempt has been made to study the effect of phyotochemicals (allelopathic) on growth and metabolism of *P. hystero phorus* to identify its suitability as a herbal herbicide.

MATERIAL AND METHODS

Fresh leaves, stem and roots of *A. paniculata* Nees were harvested from Ambai Defence Colony, Kolhapur during the months of August - October 2007, for experimental study. The collected samples were washed properly through distilled water and air dried and kept for oven at 70^{o} C for 3 days. The oven dried material of stem, leaves and roots were finely powdered in a domestic grinder separately. Pot studies were carried out during September to December 2007 in the Botanical Garden of Department of Agro chemicals and Pest Management.

The fire clay pots of 17 cm deep and 30 cm diameter were filled with equal weight of 2 1Kg loam soil and 5 g of DAP (Di ammonium phosphate). Finally powdered dried samples of leaves, stem and roots of *A. paniculata* were mixed at

the rate of 5 gm per pot separately. In each fire clay pot five viable seeds of *P. hysterophorus* were sown at equal distance. One pot was used as control, uniform watering was done i.e., 100 ml per pot continuously up to 60 DAS (Days After Sowing).After 60 days treated plant parts were used for biochemical tests and growth parameters.

The treated (residues of *A. paniculata*) leaves, stem and roots of *P. hysterophorus* were used for experiment which was laid out in randomized block design with two replicates. The chlorophyll content from leaves and stem of treated samples were extracted with 80 percent acetone along with control samples. The total chlorophylls were measured by the method of Amon (1949). The polyphenol contents were estimated by the method of Folin and Dennis (1915), the total carbohydrates and starch of treated leaves, stem and roots of *P. hysterophorus* was determined by Anthrone reagent prescribed the methods of Hodge and Hofreiter (1962) and Thayumanavan and Sadasivan (1984). The reducing sugars were calculated by dinitrosalicylic acid method (Miller, 1972). The soluble proteins were estimated by the method of Lowery *et aI.* (1951). The total lipids were estimated by the method of Blight and Dryer (1959), the amino acid content were detected by two dimensional chromatography techniques of Consdon *et aI.* (1944) using phenol: water: ammonia in the ratio of 80: 20: 3 as solvent in first run and N--butenol, acetic acid and water in the ratio of 4: 1: 5 as second run. Ninhydrin (0.1 percent W *N)* was used as spraying reagent.

RESULT AND DISCUSSION

Ground plant parts (leaves, stem and roots) of *A. paniculata* significantly inhibited the growth parameters like height, number of production of leaves and seeds per plant of *P. hysterophorus*. The germination and growth of *Parthenium hysterophorus* L was hindered, 25 percent growth was reduced in leaves and stem extracts, while 21.25 percent reduction was noticed in root extract treatment. A concomitant result was observed after 60 days of treatment. A reduction of 39.94 percent of growth was recorded in root and stem extracts.

A similar result was noticed an application of *A.paniculata* Nees residue on production of number of leaves on *P. hysterophorus* (Table 1). The number of leaves were reduced as compared to control, after 30 DAS treatment. A maximum 46.66 percent of reduction was recorded in stem residue extract as compared to control. Even after 60 DAS treatment, 36 percent of reduction was revealed in stem extracts of *A. paniculata* Nees reflects its phytotoxicity. The number of production of seeds per plant of *P. hysterophorus* L was significantly reduced (0, 10.00, 20.00 and 40.00 per cent for control, leaves, root and stem respectively). A greater reduction was recorded in stem extract after 60 DAS treatment as compared to control. Thus totally plant height, number of production of leaves and production of seeds per plant greatly decreased, may be due to phytotoxicity effect of *A. paniculata*. Allelo chemicals may have a great influence on physiology and biochemical processes. The growth inhibition of *P. hysterophorus* may be due to allelo chemicals released from leaf, stem and roots of *A. paniculala* (Thaper and Singh, 2006*).*

Table 1. Phytotoxic effect of *A. paniculata* residue on growth and development of *P. hysterophorus*

Treatment Residues	30 DAS	Plant Height Percent of reduction	60 DAS	Percent of reduction
Control	8.0	——	38.3	—-
Leaves	6.0	25.00	25.0	34.72
Root	6.3	21.25	23.0	39.94
Stem	6.0	25.00	23.00	39.94
Number of production of leaves per plant				
Control	8.0	—	25	-
Leaves	6.0	13.33	20	20.00
Root	6.3	33.33	18	28.00
Stem	6.0	46.66	16	36.00

The application of leaf, stem and root biomass of *A. paniculata* on *P. hysterophorus* (Table 2) shows reduction in chlorophyll content as compared to control. 208.78 mg of chlorophyll per 100 mg of dry weight get reduced to 174.18 mg after 60 DAS treatment. The polyphenol content were responsible for resistance has been extensively worked out (Deshpande, 1993), get

Table 2. Effect of leaf, stem and root residue powder of *A. paniculata* on biochemcial constituents of *P.hysterophorus* after 60 DAS treatment (mg per 100 mg of dry weight)

Constituents	Control	Leaves	Root	Stem
Chlorophyll a	4.185	3.907	-	2.760
Chlorophyll b	6.262	5.799	-	3.494
Total chlorophylls	208.780	174.180	-	124.920
Polyphenols	870.00	820.000	512.00	769.00
Total carbohydrates	2208.20	1615.00	592.40	718.00
Starch	61.63	18.38	12.92	13.51
Reducing sugars	236.9	53.10	147.00	43.00
Proteins	4598.36	4131.10	868.80	3073.10
Total amino acids	2.58	2.29	1.72	2.04
Lipids	14.77	12.89	6.57	4.71

significantly reduced in treated parts *of P. hysterophorus* (Table 2) after 60 DAS treatment with biomass. The reducing sugars in *P. hysterophorus* due to application of biomass get diminished in all three treated parts. A maximum reduction was observed in stem content followed by leaves. This suggests that allelo chemicals may inhibit synthesis of reducing sugars. Similarly starch content greatly reduced in all three parts, after 60 DAS treatment. Thus total carbohydrate content greatly reduced due to application of biomass of *A. paniculata* after 60 DAS. Hence, allelochemicals interferes with photosynthesis, in relation to water (Colton and Einhelling, 1980) and nutrient up take (Craig and Einhelling, 1980), which were required for the metabolism of number of organic compounds.

The plant residues of *A. paniculata* influences the amino acid composition on *P. hysterophorus* (Table 2). The total amino acids were reduced in root, stem and leaves as compared to control. The lowered synthesis of carbohydrate due to application of biomass of *A.paniculata* on *P. hysterophorus* reflects on biosynthesis of proteins. Protein content get reduced in root, stem and leaves, besides, proteins may be used as respiratory substrate, when carbohydrates supply was inadequate, due to effect of allelochemicals. The protein content get declined may be due to degradation or inhibition of protein synthesis under the influence of allelochemicals (Table 2).

The lipid metabolism was highly modified by the application of biomass of *A. paniculata* on *P. hysterophorus* (Table 2). After 60 DAS treatment, the lipid content was highly reduced in stem, root and leaves. This may be due to degradation or lipid peroxidation or inhibited synthesis under the inf1uence of allelochemicals. Thus in all biomass (allelochemicals) influence the growth and physiology *of P. hysterophorus*, therefore, residues may be used as herbal herbicides.

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T.G. Nagaraja and S.M. Deshmukh

Department of Agrochemicals and Pest Management, Shivaji University, Kolhapur- 416 004, Maharashtra, India.
E-mail: tgnagaraja@rediffmail.com