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CHANGE IN THE METABOLITES OF *TINOSPORA CORDIFOLIA* (GILOY) DURING PROGRESSIVE INFECTION OF INSECT'S PEST

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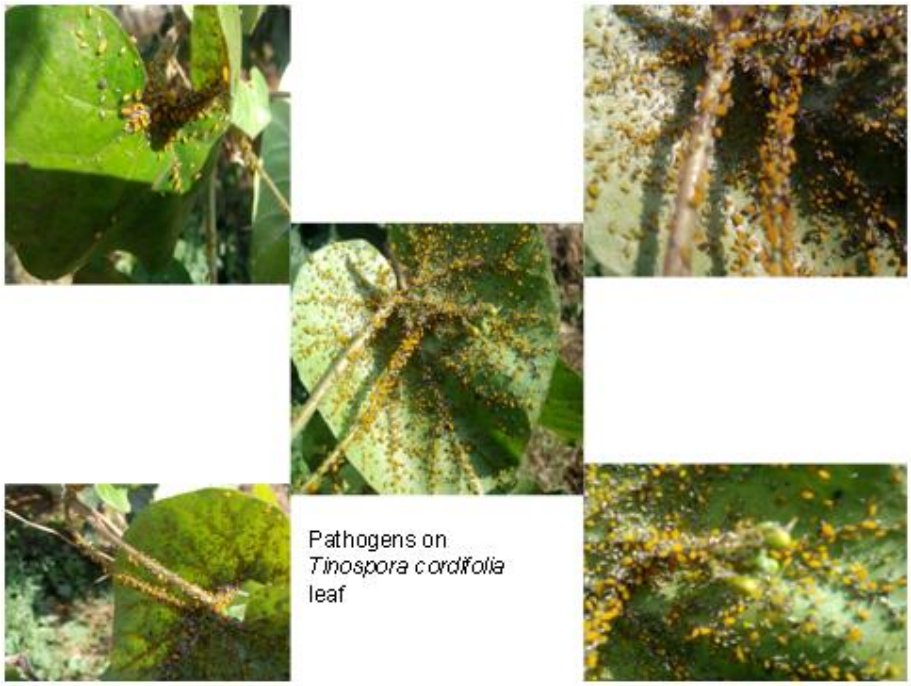
ABSTRACT

A new era of plant biochemistry at the system level is emerging in which the detailed description of biochemical phenomena, at the cellular level, is important for a better understanding of physiological, developmental, and biomolecular processes in plants. Laboratory evaluations were made to asses the study of primary metabolites of *Tinospora cordifolia*. belongs to the family menispemeacae. It contains chlorophyll, sugars, starch, protein, ascorbic acid and phenols in, leaves, stem, root and callus of the plant.Levels of plant metabolites are strongly affected bygenetic and environmental factors.Growth factors such as light, temperature, humidity,type of soil, application of fertilizers, damage caused bymicroorganisms and insects, stress induced by UV radiation, heavymetals, and pesticides all alter metabolite composition of plants. Different types of pests causes changes in plant metabolite production. The results revealed the evidence of different infestation of the plant by common herbivores.In this review we report primary metabolites of the *Tinospora cordifolia* along with the quantification after the pests effect.

INTRODUCTION

There are hundreds of medicinal plants that have a long history of curative properties against various diseases and aliments. Plants have formed the basis of sophisticated traditional medicine systems among which are Ayurvedic, Unani, and Chinese. These systems of medicine have given rise to some important drugs which are still in use [1, 2]. Primary metabolites are substances widely distributed in nature, occurring in one form or another in virtually all organisms. In plants such compounds are often concentrated in seeds and vegetative storage organs and are needed for physiological development because of their role in basic cell metabolism [3]. Primary metabolites, for example; sugars, proteins, lipids, and starch are of prime importance and essentially required for growth of plants. The studies of primary metabolites have been carried out in some plants in the past such as Balanitesaegyptiaca, Cissusquadrangularis, Eclipta alba and Neriumindicum. [4].

Plant is a large, glabrous, deciduous, climbing shrub. The stem structure is fibrous and the transverse section exhibits a yellowish wood with radially arranged wedge shaped wood bundles, containing large vessels, separated by narrow medullary rays. The bark is creamy white to grey, deeply left spirally and stem contains rosette like lenticels. The leaves are membranous and cordate in shape. Flowers are in axillary position, 2-9cm long raceme on leaflet branches, unisexual, small and yellow in color. Male flowers are clustered and female are usually solitary. The seeds are curved. Fruits are fleshy and single seeded. Flowers grow during the summer and fruits during the winter[5]. Phytochemicals are naturally occurring biochemical in plants that give plants their color, flavor, smell and texture. Preliminary phytochemical screening of medicinal plants is a useful method for qualitatively determination of different metabolite in crude sample. Many primary metabolites lie in their impact as precursors or pharmacologically active metabolites in pharmaceutical compounds such as antipsychotic drugs [6, 7]. Most of the insects or pests undergo a developmental process known as metamorphosis, which simply means that the insect changes form during its life. Metamorphosis may be complete or incomplete. Complete metamorphosis consists of four stages -- egg, larva, pupa, and adult. Plant parts chewed by the insects this processes is known as herbivory. Pest and insects are also affecting the primary metabolites of plants. Pest of vegetables is also reduces the quality of food. Food quality is largely determined by the availability of these nutrients (protein sugar carbohydrates), and its importance for longevity, size, fecundity, and death rates in herbivorous insects has been recognized early on by Painter (1936).In this review we report primary metabolites of the *Tinospora cordifolia*along with the quantification after the pests effect.



MATERIAL AND METHODS

Collection of plant material:

Plant material collected from Botanical nursery, University of Rajasthan. Plant material was authenticated by Herbarium, Department of Botany, Rajasthan University, Jaipur, Rajasthan.

Preparation of extracts:

The stem, leaf and roots of *Tinospora cordifolia* was cut into small pieces, dried and powdered. The resultant was then subjected for successive extraction with petroleum ether, benzene, chloroform, ethanol and water with soxhlet apparatus. The extracts were then concentrated in vacuum under reduced pressure using rotary flash evaporator and dried in desiccators. These extracts were then subjected to preliminary phytochemical screening for the detection of various plant constituents. Each of these extracts was processed further to evaluate the presence of carbohydrates, proteins, tannins, flavonoids and alkalids following the established protocols(8). The powder was treated with acids like 1N HCl, H2SO4, HNO3, Acetic acid and alkaline solutions like 1N NaOH and ammonia. Root, stem,leaf and callus parts of *Tinospora cordifolia* were evaluated quantitatively to estimate the total levels of chlorophyll, soluble sugars, starch, proteins, lipids and phenols following the established methods for the sugars, starch (9), lipid (10) , protein (11) and phenol(12). All experiments were repeated five times for precision and values were expressed in mean ± standard deviation in terms of air dried material.

RESULTS

Various primary metabolites in pest free different plant parts

Metabolites	Leaf	Stem	Callus	Root
Chlorophyll a	5.37 ± 0.29 gm/gdw	5.27 ± 0.39 gm/gdw	1.28 ± 0.58 gm/gdw	0.0
Chlorophyll b	4.67± 0.57 gm/gdw	4.23± 0.59 gm/gdw	1.18 ± 0.06 gm/gdw	0.0
Carbohydrate	6.17 ± 0.65 gm/gdw	4.87± 0.39 gm/gdw	7.96 ± 0.24 gm/gdw	0.67± 0.12 gm/gdw
Starch	8.44 ± 0.48 gm/gdw	9.10 ± 0.63 gm/gdw	10.37 ± 0.39 gm/gdw	8.36 ± 0.52 gm/gdw
Protein	76.06 ± 0.33 µg/mg	86.57± 0.29 µg/mg	67.09 ± 0.47 µg/mg	59.33± 0.36 µg/mg
Phenol	53.16 ± 0.65 gm/gdw	77.56 ± 0.59 gm/gdw	61.34 ± 0.76 gm/gdw	44.21± 0.53 gm/gdw

The inducing factors produced by the pests largely affect the primary and secondary metabolism of theplants, resulting in the enhanced production of certain metabolites, e.g. amino acids, sugars and total phenols. (13)

Various primary metabolites in pest infected plant parts

Metabolites	Leaf	Stem	Root
Chlorophyll a	4.17 ± 0.43 gm/gdw	3.76 ± 0.67 gm/gdw	0.0
Chlorophyll b	3.09 ± 0.84 gm/gdw	2.17 ± 0.33 gm/gdw	0.0
Carbohydrate	11.12 ± 0.37 gm/gdw	5.32 ± 0.42 gm/gdw	1.18 ± 0.29 gm/gdw
Starch	11.45 ± 0.36 gm/gdw	10.71 ± 0.87 gm/gdw	8.78 ± 0.25 gm/gdw
Protein	96.06 ± 0.23 µg/mg	108.57± 0.19 µg/mg	47.33 ± 0.21 µg/mg
Phenol	67.21± 0.33 gm/gdw	91.34 ± 0.87 gm/gdw	63.11± 0.42 gm/gdw

DISCUSSION

Preliminary phytochemical screening of plant is very useful for determination of the active constituents in different solvents and their yields. Most of the active principles are found in alcoholic and aqueous extracts. Our results were in agreement of previous reported results. Many primary metabolites lie in their impact as precursors or pharmacologically active metabolites in pharmaceutical compounds. Plant synthesizes primary metabolites (lipid, protein, starch, sugars, phenol etc.) for the normal growth and development of itself. Many polysaccharides purified from Chinese medicinal herbs and phenols are bioactive and possess immuno- modulating, anti-tumor and antibacterial activities. (14)

CONCLUSIONS

Primary metabolites chlorophyll, proteins, lipid, soluble sugar, starch and total phenol contents are quantified in different plant parts (root, stem, callus and leaves) and shown (in table 1). Pest

free vegetable part contained total sugar (7.96±0.24gm/gdw) highest in callus, whereas, starch (10.37±0.37gm/gdw) highest in callus and moderate in stem (9.10±0.63 gm/gdw), proteins (86.57±0.29 µg/mg) highest in stem, chlorophyll a (5.37±0.29gm/gdw) and chlorophyll b (4.67±0.57gm/gdw) highest in leaves. Callus show maximum concentration of metabolites as compared to its leaf, stem and roots. Pest infected vegetable parts contained total sugar (11.12±0.37gm/gdw) in leaves starch (11.45±0.36 gm/gdw) in leaves, proteins (108.57±0.19 µg/mg) in stem, chlorophyll a (4.17±0.43gm/gdw) and chlorophyll b (3.09±0.84gm/gdw) in leaves. Leaves shows maximum primary metabolites as compared to its stem and roots. Plant synthesizes primary metabolites (lipid, protein, starch, sugars, phenol etc.) for the normal growth and development of itself.

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