

Adaptive mechanism in some plants of Tropical Arid Region of Maharashtra

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Abstract

In present investigation attempt have been made to identify role of secondary metabolites in phylogenetically different traits of weeds like *Tinospora cordifolia* (Thunb) Miers., *Aristolochia bracteolata* Lam. and *Cassia tora* L. in drought prone dry arid region of Maharashtra. The climber species *T. cordifolia* is most primitive among these three close to Ranunculales showing the highest quantities of terpenes and flavonoids. *C. tora* a common herb and dominant weed belongs to order Rosales it co-ordinates with pathological protection being a leguminaceae member with elevated levels of polyphenols for dispersal of fruit and seeds. In *Aristolochia* most of the flowers range from blue to deep pink prevailing larger amount of anthocyanins. The various magnitude of lipids peroxidase reflects ageing process within the leaf in these three plants.

All plants produce secondary metabolites and their distribution implies they are of prime importance in survival and are often restricted to taxonomically related plant groups. India is bestowed with enormous biodiversity of weeds has wide array of bioactive principles as well as it has been proven medicinally important plant, have not received considerable scientific attention.

Secondary metabolites, present in a plant, function as defense and signal compounds important for the plant's survival and reproductive fitness reflects adaptations and particular life strategies embedded in a given phylogenetic framework¹³. They are strongly

dependent on the environmental conditions and have impact on the metabolic pathways responsible for the accumulation of the related natural products¹. Plant species adapted to the conditions of arid climate in long-term evolution respond differentially to variation in water addition in terms of metabolomics¹¹. Different plant taxonomic groups, reflected by the type and concentration of the secondary metabolites is part of chemical defense response system associated with increased resistance to stress¹⁰.

The healthy plants of *T. cordifolia*, *C. tora* L. and *A. bracteolata* Lam. at their optimal growth were collected from fields with

homogeneous population for further studies. Total polyphenols were determined². The anthocyanins were estimated by method⁷. The Thiobarbitric acid (TBA) assay for lipid peroxidation was carried out⁵. The tannin content was estimated by Folin-Denis method⁹. Total flavonoid content was estimated⁶.

Cassia tora L. is rich in polyphenol as compared to *A. bracteolata* Lam. and *T. cordifolia* for efficient dispersal of fruits and seeds. Higher levels of flavonoides in leaf tissue of *T. cordifolia* justifies its primitive nature may contribute to the antioxidant metabolism against pathogen attack as this is medicinally important species. Highest anthocyanins in *A. bracteolata* Lam. levels as compared to other plants contribute to attract insects for more advanced effective cross pollination. Maximum lipid peroxidation levels in leaves of *C. tora* L. may be helpful in protection against adverse environmental conditions as this dominant weed blooms under extreme hot seasons of this area. Higher amount of tannin content in leaves of *T. cordifolia* may be useful against attack of predators making their taste bitter and astringent (Table-1).

The climber species *Tinospora* is most primitive among these three close to ranunculales and showing the highest quantities of terpenes and the form of flavonoides. Flavonoides is major significant secondary metabolite in higher pteritophytes that is order of filicales and in higher gymnosperm that is in order gnetales because of angiospermic trend its close association with the malvales group it also shows to the high content of tannins. *C. tora* a common herb and dominant

weed belongs to order rosales and this group is from biochemical point of view signifies occurrence of polyphenols. Polyphenols have been developed as an effective mechanism for dispersal of fruit and seeds and also it co-ordinates with pathological protection being a leguminaceae member. *Aristolochia* is a member of highly advanced angiosperm belonging order unisexuales where the highly effective mechanism of pollination shows very bright flowers and highly specialized cross pollination through diptera group of orthopods as this group can only identify blue and violet color more dominantly prevailing larger amount of anthocyanins. The various magnitude of lipids peroxidase reflects ageing process within the leaf in these three plants.

Secondary metabolites are the representative of the photooxidation process which represents the progressive evolutionary trend polyphenols and flavonoides are double bond cyclic aromatic groups represent a primitive trait like pteridopsida and gymnospsida and also its prevails the formation of resins that is saturated hydrocarbon can be further broken are usually deposited in the older part and if they are soluble they are categorised as tannins. Anthocyanins represent the group of organic compounds which are responsible for absorbing the UV-radiations. High amount of flavonoides and tannins in *T. cordifolia* along with large amount of anthocyanins in *A. bracteolata* reflects the advancement of group unisexuales which now considered under a separate series Daphnales.

In the course of evolution plants deal with various complex types of interactions involving numerous environmental factors, they have evolved specific mechanisms to adapt

Table-1. Secondary metabolites in leaves of *A. bracteolata* Lam. *T. cordifolia* and *C. tora* L.

Sr. No.		<i>Aristolochia bracteolata</i> Lam.	<i>Cassia tora</i> L.	<i>Tinospora cordifolia</i> (Thunb) Miers.
1.	Total Polyphenols ($\mu\text{g/gm}$ fresh tissue)	155	195	180
2.	Total Flavonoides ($\mu\text{g/gm}$ fresh tissue)	2702.70	1785.71	2941.17
3.	Anthocyanins (nm absorbance unit)	0.626	0.547	0.443
4.	Lipid peroxides (μ mole/gm fresh tissue)	0.126	0.136	0.093
5.	Tannins ($\mu\text{g/gm}$)	55	75	90

and survive in stressful events⁸. Investigating of stress-associated genes and pathways involved in biosynthesis of the secondary metabolites in medicinal plants is carried out by many workers. Sesquiterpenes is associated with defense response system in members of the family Solanaceae, glucosinolates-myrosinase are produced by the Brassicaceae members, stilbenes in Vitaceae, isoflavones in Fabaceae while limonoids are produced by Rutaceae and Meliaceae³. Isoflavonoid phytoalexins in soybean and alfalfa and sesquiterpenes by family Solanaceae⁴. Higher accumulation of alkaloids in the seeds of most plants could be considered a chemical defensive strategy and source of nitrogen during germination¹².

Our findings not only impending the progressive evolution in secondary metabolites but also the role of environment and sustenance of these weed under arid conditions. This study is a marker to identify the correlation of other secondary metabolites, their formation and accumulation in different weeds and its inference from phylogenetic point of view such studies are in progress.

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