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CHEMOSYSTEMATICS OF GENUS THUNBERGIA (A - MINI REVIEW)

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Abstract:

Genus- Thunbergia (Acanthaceae) as important medicinal and aromatic plant widely used as different pharmacological experiments in a number of in vitro *and* in vivo *models have convincingly demonstrated the ability of Thunbergia species to exhibit antifungal, antibacterial, antioxidant, detoxification, antipyritic and hepatoprotective activities,lending support to the rationale behind several of its therapeutic uses. Thunbergia are considered to be responsible for its the volatile aroma compounds iridoids. The present review is an up-to-date and comprehensive analysis of the chemistry, pharmacology, traditional uses and safety of this genera.*

Key Words: Thunbergia, Iridoids & Chemosystematics

1. Introduction:

The subject of Phytochemistry, or plant chemistry, has developed in recent years as a distinct discipline, somewhere in between material product organic chemistry and plant biochemistry and is closely related to natural products. It is concerned with the enormous variety of organic substances that are elaborated and accumulated by plants and deals with the chemical structures of their substances, stereochemistry, dynamic aspects (reaction) their biosynthesis, turnover and metabolism, their natural distribution and their biological function[1].

Plants have an almost limitless ability to synthesize aromatic substances mainly secondary metabolites, of which at least 12,000 have been isolated, a number estimated to be less than 10% of the total. In many cases, these substances serve as the molecules of plant defence against predation by microorganisms, insects, and herbivores. Further, some of which may involve in plant odour (terpenoids), pigmentation (tannins and quinines), and flavour (capsaicin). Natural products and their derivatives including antibiotics represent more than 50% of all drugs in clinical use in the world. Higher plants contribute about 25% of the total. Hence, medicinal plants are believed to be an important source of new chemical substances with potential therapeutic effects. Many drugs commonly used today are of herbal origin because of their safety, quality and efficacy. Herbal drugs, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and new chemical entities. Sweetners, flavour, fragrances, and a number of health care related products from plant origin[2-3]

Thunbergia is an old world tropical genus of some 100 species, with a number of ornamental and medicinal taxa. Jansen, Sorendamtoft, Ismail and Kanchapoom[4-7] reported that several interesting iridoid glycosides (A subclass of iridoid (mono terpenoid) compounds that include a glycoside moiety, usually found at the C-1 position have been reported from *T.alata, T.grandiflora T.fragrans, T.mysorensis* and *T.laurifolia* . The present review is an up-to-date and comprehensive analysis of the chemistry, pharmacology, traditional uses and safety of this genera.

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2. Chemistry of Iridoids and Secoiridoids:

Iridoids are monoterpenoids based on a cyclopentan-[C]-pyran skeleton which may consist of ten, nine, or rarely eight carbon atoms in which C_{11} is more frequently missing than C_{10}. Oxidative cleavage at 7, 8-bond of the cyclopentane moiety affords the so called secoiridoids. The stereo chemical configurations at C_5 and C_9 leading to *cis* fused rings is common to all iridoids containing the basic carbocyclic- or seco-skeleton in non-rearranged form. The last steps in the biosynthesis of iridoids are considered to be O-glycosylation and O-alkylation. It is the significance of iridoid biosynthesis in chemo systematic studies or, in other words, the use the biosynthetic routes as tools for understanding the systematic positioning of iridoid containing plants. Iridoids and Secoiridoids are useful phytochemicals in a number of folk medicinal plants and many of them possess significant biological and pharmacological activities. Some of them are Chemotoxinomically useful as markers of genus in various plant families. Caffeyol, cinnamoyl, comaroyl, feruloyl, isoferuloyl as a substituent or precursors in trans configuration[9-12].

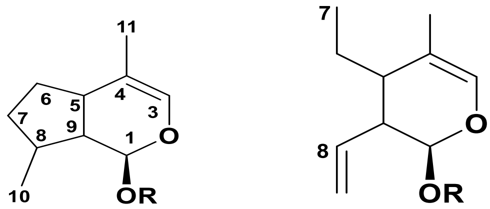


Figure: Numbering system for iridoid and seco-iridoid compounds- R=H or glucose

3. Classification of Iridoids:

Iridoid can be classified as in different groups according to the basic carbon skeleton of the aglycone it is explained illustratively given below in figure. 2

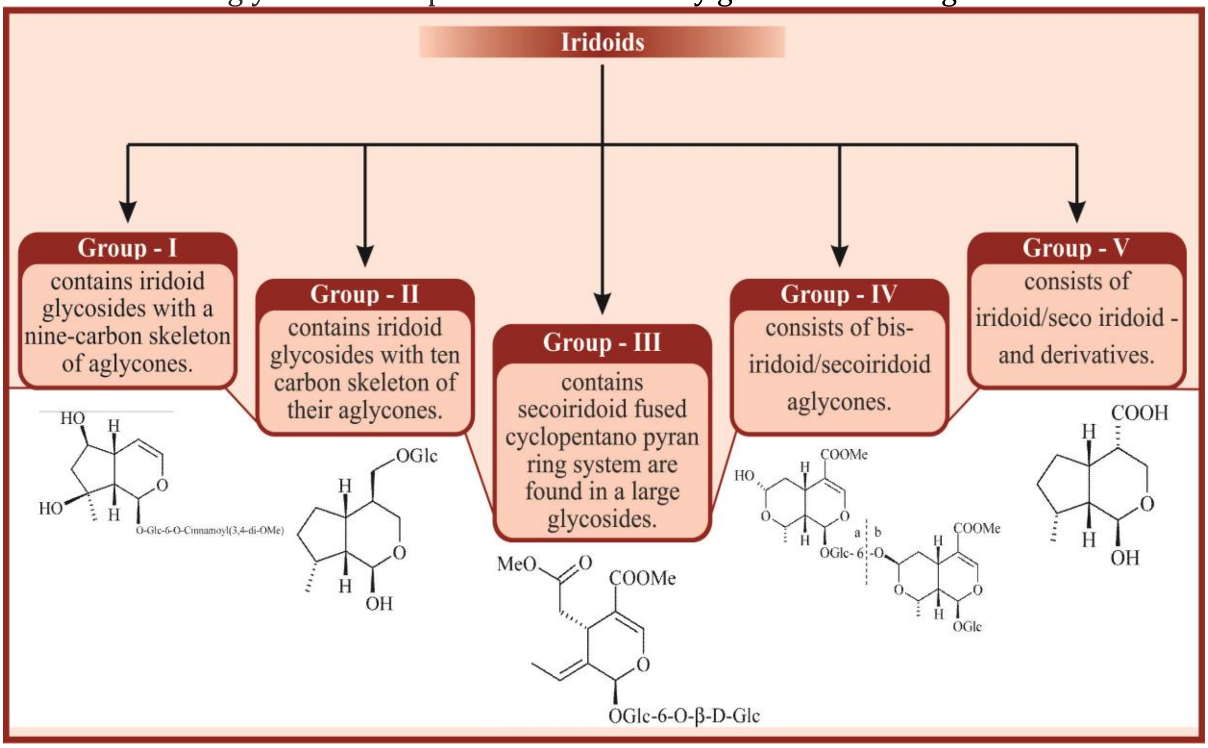


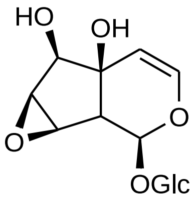
Figure: Classification of Iridoids

4. Biogensis of Iridoids:

Iridane skeleton may involve a double Michael-type addition of geranyl pyrophosphate to yield iridodial. Iridoids may be envisaged as a biogenetic alternative to the typical monoterpenes and there is evidence for an inverse relationship between the production of monoterpenes and iridoids in the Lamiaceae, Scrophulariaceae, Plantaginaceae, Daphniphyllaceae , Apocynaceae , Actinidiaceae and Acanthaceae families. The secoiridoids form the largest class of iridoid compounds found as glucosides commonly, in modified forms as secoiridoid-indole alkaloids[13]. Over 2500 iridoids have so far been found to occur in nature, in the basic cyclopentane ring system. However the most distinct chemical feature among them is the biosynthetic derivation explored by the different plant groups[14-15].

5. Chemotaxonomy of Thunbergiea:

Recent work on the Chemotaxonomy of Acanthaceae reported the presence of iridoid glycosides in the sub family Thunbergiodeae and all the five species of *Thunbergiea* investigated were all of to contain such compounds i.e. stilbericoside (1), 6-epi stilbericoside (2), thunbergioside (3), alatoside (4 &5), thunaloside (6), antirrhinoside (7), unedoside (8), epoxide cleavage product by Li/NH_3 of unedoside (9) and 10- hydroxyloganin and its isomeric forms (7a-7c). Moreover, Kanchapoom et al found to contain grandifloric acid (12), 8-epi-grandifloric acid (13) and newly found iridoid di-glycosides i.e. 3'-O-β-glucopyranosyl-stilbericoside (14) from *Thunbergia laurifolia* leaf extract.



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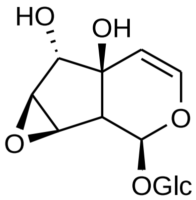

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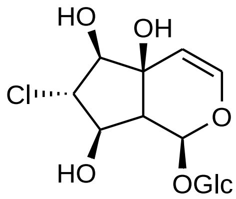

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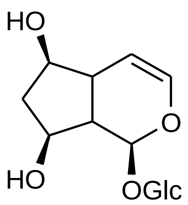

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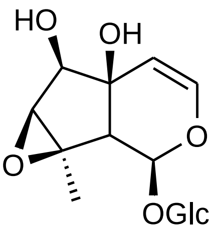
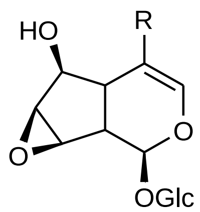


$R = CH_3$

R = H

6



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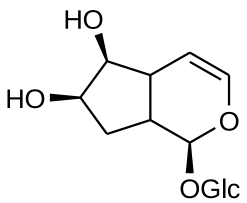

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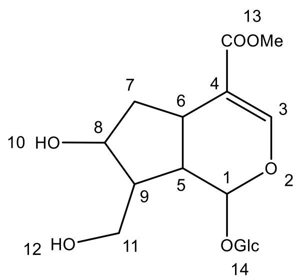
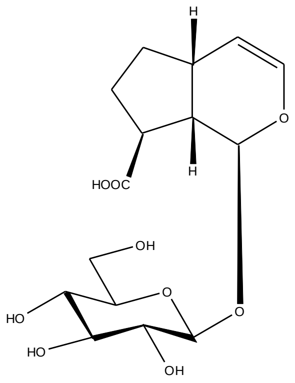


7β, 8β: Isomer - A
7α, 8α: Isomer - B
7α, 8β: Isomer - C
7β, 8α: Isomer - D

9-10



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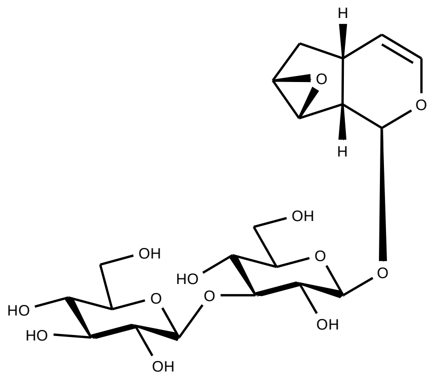

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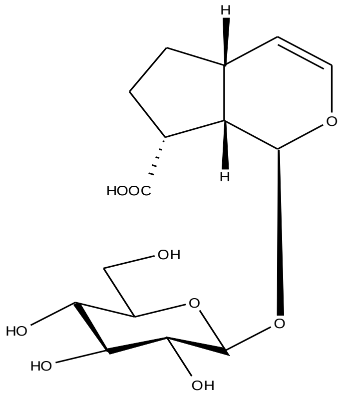

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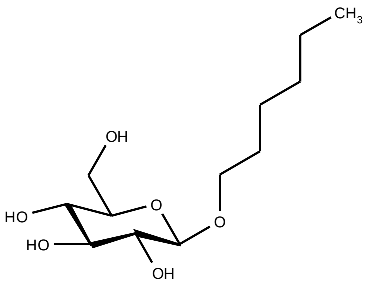
Kanchapoom led to isolation of aliphatic and aromatic glycosides such as n-hexyl-β-glucopyronoside (74), benzyl-β-glucopyronoside (75) and benzyl β-(2'-O-β–glucopyronosyl) glucopyronoside (76) from *Thunbergia laurifolia*. Oonsivilai and Purnima[16-17] research groups investigated in *Thunbergia laurifolia* leaf extract contains phenolic acids such as chlorogenic acid, caffeic acid and protocatechuic acid.



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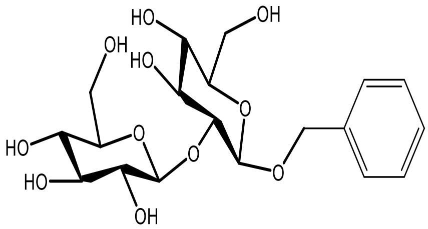

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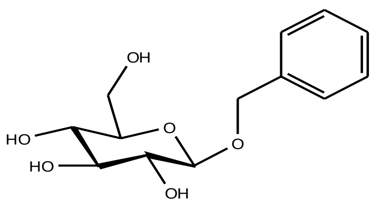

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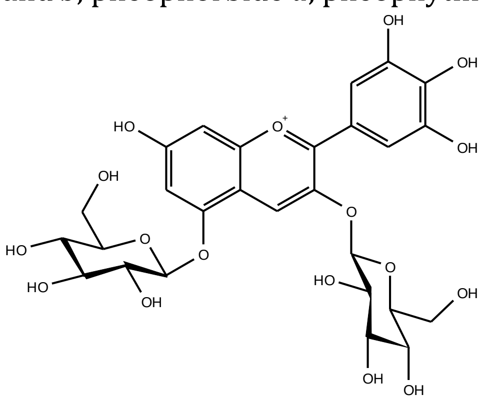
Kanchapoom and his group led to isolation of both flowers and leaf materials of *T.laurifolia* have been found to contain other bioactive phenolic constituents including delphinidin 3:5- di –O- β glucopyronoside (15), apigenin (16), apigenin-7–O- β glucopyronoside (17), 6-C-glucopyronosyl apigenin (18), 6, 8 -C- glucopyronosyl apigenin (19). Ratchadaporn Oonsivilai reported limited information available regarding the characterization of the lipophilic from TL leaf extract (i.e. Chlorophyll *a* and *b*, pheophorbide *a*, pheophytin *a*, and lutein).



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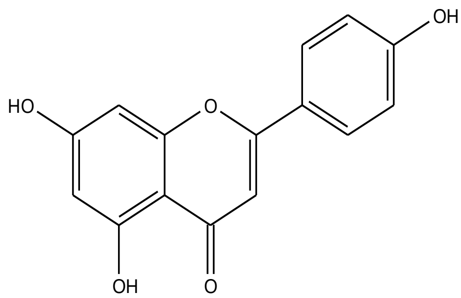

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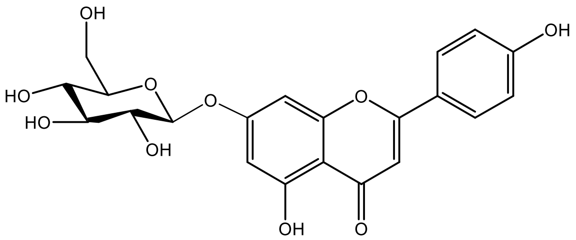

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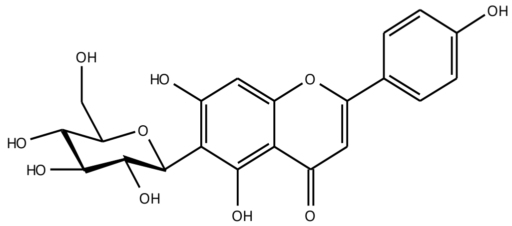

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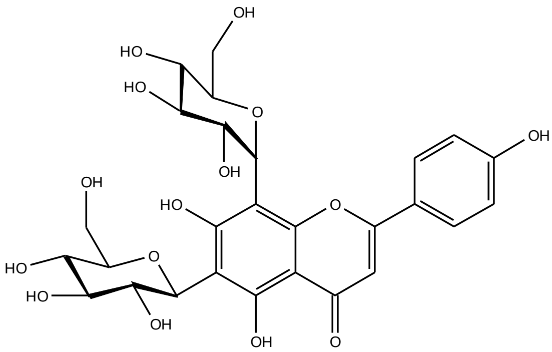

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6. Pharmacology of Genus *Thunbergia*:

Chanawirat and Charumanee et al suggested that the trumpet vine *Thunbergia laurifolia* Linn. (TL) is a Thai medicinal plant known for its anti-mutagenic, anti-inflammatory and antipyretic properties. Sunyapridakul, Tejasen, Thongsaard and Ussanawarong [18-19] reported that the aqueous extract of fresh leaves, dried leaves, dried root, and bark of TL has been used in detoxification and first-aid treatment for poisoning from insecticide, ethyl alcohol, arsenic and strychnine. TL leaf extract was shown to be an antidote against the insecticide parathion.

Pramyothin and his researchers [18] reported that the hepatoprotective effect of aqueous extract from TL leaves, firstly, to estimate its hepatoprotection against ethanol in primary cultures of rat hepatocyte and secondly, to examine its promotion of liver recovery in ethanol treated rats. Srida et al [19-25] studied and suggested that the phenolic compounds in TL leaf aqueous extracts could function as superior anti-oxidants and as well as a chelating agent.

The studies were examined the hypoglycemic activity of methanol and chloroform extracts of the whole-parts of *T.alata* in glucose-loaded mice (oral glucose tolerance test). Both methanol and chloroform extract demonstrated significant hypoglycemic activity. *T. grandiflora* find use as broad-spectrum antimicrobial activity. *T.fragrans* showed anti-oxidant and antipyretic activity

7. Conclusion:

Thus, the present study had focused on review on phytochemical and bio-activity studies of traditional medicinal plants –Genus *Thunbergia* plants were found to be the new sources of phytoconstituents with many biochemical and pharmacological activities. The biologically active components present in these medicinal plants might be useful in modern medicine. These local ethnomedical preparations and prescriptions of these plant sources had been scientifically evaluated in this study. Thus, the chosen traditional medicinal plants might find use in the field of pharmacology, phytochemistry, ethnobotony and other biological activity studies for drug discovery.

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