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CHEMOTAXONOMY OF HEDYSAREAE (PAPILIONACEAE)[1]

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ABSTRACT

The chemotaxonomy of 9 species distributed over 6 genera of the tribe Hedysareae (Papilionaceae) has been studied. The taxa of the tribe exhibit heterogeneity in their chemical characters despite certain resemblances. Though Hedysareae may be considered as the starting point for the other tribes in view of the heterogeneity in chemical as well as other characters the need for examining profiles of different chemical compounds like flavonoids, alkaloids etc. in the light of their evolutionary significance to confirm this view is pointed out.

INTRODUCTION

The Papilionaceae are a large family comprising 500 genera and 12,000 species (Heywood, 1971). They are worldwide in distribution with woody representatives in the tropics and shrubby and herbaceous members in temperate regions. Bentham and Hooker (1862-1883) recognized 11 tribes and Gamble (1918) and Cooke (1901-1903) recognized 9 tribes. The present study deals with the chemotaxonomy of 9 species, distributed over 6 genera, namely *Aeschynomene aspera* L., *A. indica* L., *Alysicarpus hamosus* Edgew., *A. monilifer* Edgew., *A. vaginalis* DC., *Arachis hypogaea* L., *Desmodium gangeticum* (L.) DC., *Ougeinia dalbergioides* Benth., and *Zornia gibbosa* Spanoghe (*Z. diphylla* Pers.).

MATERIALS AND METHODS

All the materials under the present study except *Desmodium gangeticum* and *Ougeinia dalbergioides* were collected locally at the time of flowering and fruiting. *Desmodium gangeticum* and *Ougeinia dalbergioides* were collected from Pakhal forest, Warangal district. A part of the material of *Desmodium* was obtained from Botanical Survey of India, Calcutta.

Using fresh materials consisting of stems, leaves, roots and fruits Aurone test, HCl/Methanol test (Isenberg and Buchanan, 1945), HCN test 'A' (Gibbs, 1974), Leucoanthocyanin test 'A' (Bate-Smith, 1954), Maule test (Maule, 1900), Saponin test (Amarsingham *et al.*, 1964) and Syringhin test 'A' (Turnmann, 1931) adopted by Gibbs (1974) were carried out.

Test for carbohydrates (Molisch test), triterpenoids (Noller test, triterpenoids/steroids (Libermann-burchard test), steroid components (Salkowski reaction), saponins, alkaloids, flavonoids, phenols and Labat test were carried out using 80% methanolic extracts of entire plants during flowering and fruiting.

RESULTS AND DISCUSSION

The results of the present study are presented in the tables I and II. Aurone test was negative in *Arachis hypogaea*,

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TABLE I

TESTS WITH FRESH MATERIALS

Name of the plant	Aurone test 'A'	Ehrlich test	HCL Methanol test	HCN test 'A'	Leucoan-thocyanin test 'A'	Maule test	Saponin test 'A' 'A'	Syrin-gin test
Aeschynomene aspera L.	—	+	+	—	+	+	—	—
A. indica L.	.	+	—	—	+	+	—	—
Alysicarpus hamosus Edgew	.	—	—	—	—	+	?	?
A. vaginalis (L.) DC.	.	—	—	—	—	+	—	—
A. monilifer Edgew	.	—	—	—	—	+	?	—
Arachis hypogaea L.	—	—	—	—	traces	+	+	—
Desmodium gangeticum DC.	.	+	—	—	+	+	—	—
Ougeinia dalbergioides Benth.	.	+	+	—	+	+	—	?
Zornia gibbosa spanoghe (= *Z. diphylla* Pers.)	—	—	—	—	—	+	—	—

TESTS WITH 80% METHANOLIC EXTRACT

Name of the Plant	Alkaloids	Flavonoids	Indoles	Labat test	Libermann-Burchard test	Molisch test	Noller tsest	Phenols	Saponins	Salkowski reaction	Tannins
Aeschynomene aspera	—	+	—	—	+	+	+	+	—	—	—
A. indica	—	+	—	—	+	+	+	+	—	—	—
Alysicarpus hamosus	—	+	—	—	—	+	—	+	?	—	—
A. vaginalis	—	+	—	—	+	+	+	+	—	—	—
A. monilifer	—	+	—	—	—	+	—	+	?	—	—
Arachis hypogaea	—	+	—	—	+	+	+	+	—	—	—
Desmodium gangeticum	+	+	—	—	+	+	+	+	—	—	—
Ougeinia dalbergioides	+	+	—	—	+	+	+	+	—	—	+
Zornia gibbosa	—	+	—	—	+	+	+	+	—	—	—

TABEL II

Name of the plant	5% NaoH	Conc. H_2So_4	Mg/HCl	Floavonoid type
Aeschynomene aspera	Yellow	Yellow	Yellow	Isoflavones
A. indica	,,	,,	,,	,,
Alysicarpus hamosus	,,	,,	Orange	Flavones
A. vaginalis	,,	,,	Yellow	Isoflavones
A. monilifer	,,	,,	,,	,,
Arachis hypogaea	,,	,,	,,	,,
Desmodium gangelicum	,,	,,	,,	,,
Ougeinia dalbergioides	,,	,,	,,	,,
Zornia gibbosa	,,	,,	Magenta	Flavones

Aeschynomene aspera and *Zornia gibbosa* (*Z. diphylla*). HCl/Methanol test was positive in *Aeschynomene aspera* and *Ougeinia dalbergioides* and *negative* in the rest of the taxa. However, in *Aeschynomene indica* and *Alysicarpus vaginalis* the supernatant liquid turned pink. Leucoanthocyanins detected in the leaves, stems and roots of *Aeschynomene aspera, A. indica, Desmodium gangeticum* and *Ougeinia dalbergioides* were present in traces in *Arachis hypogaea* and *absent in* Alysicarpus vaginalis, *A. hamosus, A. mionilifer* and *ornia gibbosa*. Tayeau and Masquelier (1949) extracted a leucoanthocyanin from the testas of *Arachis hypogaea* and in the present study a positive reaction for leucoanthocyanins was obtained from the seeds of all the taxa. Ehrlich test was positive as indicated by the development of magenta colour in spot 1 in *Aeschynomene aspera, A. indica, Desmodium gangeticum* and *Ougeilnia dalbergioides* (this confirms the presence of leucoanthocyanins) and negative in the rest of the taxa studied. Saponins were absent in all the taxa except in *Alysicarpus monilifer* and *A. hamosus* where a doubtful presence was indicated. Syringin test was negative in all the taxa (present study) except *Alysicarpus hamosus, A. vaginalis* and *Ougeinia dalbergoides* where the reaction was doubtful. Positive reaction for Libermann-Burchard and Noller tests and negative reactions for Salkowski reaction is indicative of the probable presence of triterpenoids in *Aeschynomene aspera, A. indica, Zlysicarpus vaginalis, Arachis hypogaea, Zesmodium gangeticum, Ougeigioides* and *Zornia gibbosa* while they were absent in the rest of the taxa. Steroids were characteristically absent in all the taxa studied *Ougeinia dalbernia dalbergioides* and *Desmodium gangeticum* stand distinct from all the other taxa (present study) in the presence of alkaloids. In the presence of tannins *Ougeinia dalbergioides* differs from the rest of the taxa studied (present study) on the basis of colour reactions (See Table II) the presence of flavones in *Zornia gibbosa* and *Alysicarpus hamosus* and isoflavones in the rest of the taxa under the present study has been inferred.

Thus, the different taxa of the tribe Hedysareae exhibit differences in their chemical characters indicating the heterogeneity of the tribe. However, the taxa of the tribe (present study) resemble one another in the uniformly positive ieactions for Maule test, Flavonoid test, Molisch test, Phenol test and uniformly negative reactions for HCN test, indoles, Labat test and Salkowski reaction.

Vishnu Mittre and Sharma (1962) investigated the palynology of Leguminosae including Papilionaceae and from an analysis of the apertural morphoforms Tewari and Nair (1979) suggested that the tribe Hedysareae forms the basic tribe from which the tricolporate line composed of Podalyrieae, Genisteae, Trifolieae, Loteae, Galegeae, Vicieae, Dalbergieae, Sophoreae, Swartzieae and the triporate line typified by phaseoleae have diverged. According to Tewari and Nair (1979) the tribe Hedysareae with the dominance of tricolpate pollen is the most primitive.

The diploid chromosome number in the tribe Hedysareae is also variable. However, the number 20 is common to all the taxa of the tribe under the present study (Federov, 1974). The haploid number of chromosomes in *Desmodium gangeticum*, *D. perpesium* (Kawakami, 1930), *D. grandiflorum* (Cooper, 1936), *D. canadense* and *D. tortuosum* (Senn, 1938) is 11 and this number is comparatively rare in Leguminosae.

According to Rau (1953) the tribe Hedysareae shows considerable variation in the development of embryo, particularly in the organization of the suspensor. Guignard (1881) found that there are suspensorless members as well as those with a massive suspensor. Similarly, variation exists in regard to the organization of the endosperm. Guignard (1881) investigated several species of the tribe Hedysareae and noticed considerable variation in regard to the time of initiation of wall formation in the endosperm. It may also be pointed out that the Bisporic type of embryo sac ontogeny occurs in *Ougeinia dalbergioides* (Seshavataram, V. personal communication) while in the rest of the taxa it follows the Polygonum type.

Analysing the data on megasporogenesis in Papilionaceae, Rembert, Jr. (1971) pointed out that evolution of the tetrad tendencies have taken place through the tetrad pattern III stock of Hedysareae, to Trifolieae. According to him Galegeae, Vicieae and Phaseoleae arose from Trifolieae. According to Hutchinson (1964) the propensity of the tribe Hedysareae for advancement is unsurpassed by any other tribe.

Studies on the epidermal structures and ontogeny of stomata in Hedysareae Kothari and Shah, 1975) reveal the heterogeneity in their characters. *Aeschynomene*, *Desmodium* and *Ougeinia* received greater attention from the point of wood anatomy and they differ significantly in their anatomical characters (Metcalfe and Chalk, 1950).

From the forerunning discussion it is clear that the tribe Hedysareae is heterogenous not only in chemical characters but also in anatomical, embryological, palynological and cytological characters. Though it is probable that such a taxon may be the starting point for the other tribes of this family, it is necessary to examine the profiles of different chemical compounds like flavonoids, alkaloids etc. in the light of their evolutionary significance to confirm this view.

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