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THE GENUS *TRIGONELLA* – PHYTOCHEMISTRY AND BIOLOGY

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ABSTRACT: The genus trigonella is an annual plant distributed in the Mediterranean region and it comprises several species. The present report deals with the dietary, medicinal, biochemical biological and various pharmacological properties.

INTRODUCTION

Trigonella (Fam.-Fabaceae), is distributed in the Mediterranean region, Europe, Asia, south Africa and Australia, According to bentham and hooker, it is placed in the class – Dicotyledonae, subclass –Polypetalae, series – Calyciflorae, Order – Rosales, family- Fabaceae and sub-Family – Paplionatae. The name of the genus trigonella is derived from the form of its corolla (Grieve, 1959).

It comprises of several species viz., *T. carulea* (L) ser *T. corniculata* Linn., *T emodi benth*., *T fischeriana* ser., *T. foenum-graecum* Linn., *T. gladiata* boiss. *T. gracilis* benth., *T. occulta* Delile, and *T. polycerata* Linn., etc out of which *T. Foenum-graecum* is the main cultivated species for culinary and medicinal purposes, and also of fodder.

T FOWNUM- GRAECUM L

Cultivation: It is commonly known as methi which is an annual herb grown as a condiment or pot herb, also for fodder and soil improvement in the Mediterranean countries and east to southern U.S.S.R and India it is either sown in spring or in autumn, depending upon the climate. In India, it is usually a cold season crop cultivated with or without irrigation.

Morphology: it is an aromatic annual, 30-60cm tall, leaves 3 – foliolate, flowers white or yellowish white and pods greenish brown. It is a self-pollinated, short duration and multipurpose cash crop (green vegetable, fodder, manure, condiment and medicinal) of India with commercial potential source for extraction of diosgenin (Fazli and Hardman, 1968).

Medicinal Uses: Medical papyri from ancient Egyptian tombs report that it was used to reduce fevers and as a food. In religious rites it was one of the numerous components of the celebrated kuphi (holysmoke) an Egyptian compound of incense used in fumigation and embaming.

Its seeds possess a significant place in the Ayurvedic system of medicine as these are carminative, antipyretic and anthelmintic (Kirtikar and Basu, 1975) and used in colic flatulence, dysentery, diarrhea dyspepsia with loss of appetite, chronic cough, dropsy, enlargement of liver and spleen, rickets, gout and diabetes besides the insect repellent properties (Nadkarni and Nadkarni, 1954). Subsequently, its seeds have also been

reported to possess various significant activities such as antifertility (Sethi et al., 1990, sethi, 1991), antitumor (soliman 1972 a, b), hypocholesterolaemic (Khare and feroz, 1982; singhal et al., 1982: Sharma and Bajaj, 1984; Sharma, 1986; Valette et al, 1984; Sharma, 1986; Valette et al., 1987); hypoglycaemic (Shani et al., 1974; Iribaren and pomilio 1983; Ribes et al 1986; Jain et al., 1987; Amin Riyad et al., 1988; Muller et al., 1988; pahwa, 1990; Nehar et al 1992).

Fenugreek is employed today in Indian and Ethopian medicine as a carminative and tonic for gastric troubles, when soaked in water the seeds swell and produce a soothing mucilage said to aid in digestion. Fenugreek seeds are also used by Indian women for its alleged power to promote lactation and its ground fine powder mixed with cotton seeds, is fed to cows to increase the flow of milk (Kirtikar and Basu, 1935).

Taste: Fenugreek has a strong, pleasant, sweetish odour reminiscent of that of burnt sugar. The taste is decidedly farinaceous and slightly bitter.

Chemistry: Chemically, its seeds are reported to contain ~ 28% mucilage. As a surface it is as effective as Guar gum, improving the strength characteristics of commercial coating-bases. Dried mucilage has remarkable swelling properties and may find application ad an adjuvant in pharmaceutical preparations, as tablet disintegrator it is more effective than alginic acid. It contains 5% of a stronger-smelling bitter fixed oil, ~ 22-30% proteins (Kolousek and Coulson, 1955; Sauvaire et al., 1976; Ladizinsky, 1979; Vasi and kalintha, 1980; Sauvaire and baccou, 1984; Benten et al., 1990), carbohydrates (Reid, 1971; Reid & Meier, 1971; Singh et al, 1973; Foglietti and percheron, 1976; Niranjan and Katiyar, 1979; El –Mahdy and El-sepaiy, 1986; Madar and shomer, 1991; Venkata, 1992), ascorbic acid (venkataramni 1950; Rowlands, et al., 1966; Sood and Bhatt, 1974; Jain et al 1975; Kucherov and Mikhailova, 1978; Chaudhary and Rao, 1979; Jones and Hughes, 1983; Sreeramulu et al., 1983), nucleic acid (Asha et al., 1979), lipids (Rathee et al., 1980; Varshney and Vyas, 1980; Girardon et al., 1985) phenols (Rao and Sriramulu, 1977), essential oils (Lawrence, 1987) and volatile oils, Except these, its seeds also contain various pharmacologically important bioactive compounds such as flavonoids – like kaempferol, luteolin, apigenin, quercetin vitexin isovitexin vicenin-I and vicenin-II (Ganju and Puri, 1959; Varshney and Sharma 1966; Adamska and Lutomski, 1971; Wagner et al., 1973; seshadri et al., 1973; sood, 1975 sood et al., 1976; Bhardwaj et al., 1977); alkaloids-trigonelline (klein and linser, 1932; Kuhn and Gerhard 1943;) which exhibited the hypoglycaemic activity; carotenoids (sadana and ahmed 1949) coumarins (parmer et al. 1982); steroid sapogenin peptide ester (totte and vlietinck, 1983); and a rich source of saponins and sapogenins, both of triterpenic and steroidal types (Ghosal et al., 1974). The work of Fazli and Hardman (1968) brought fenugreek seeds into prominence as a potential source for the production of corticosteroids due to the presence of higher level of diosgenin upto 2.2%. Subsequently, extensive work was carried out on the isolation and identification of saponins and steroidal sapogenins in *T. foenum-graecum* (Marker et al., 1943, 1947; Heitz, 1959; Bedour et al., 1964; Bakshi and Hamied, 1971; Harman, 1971; Varshney and sood 1971; Hardman and Fazli, 1972; Dawidar and Fayex 1972; Jefferies and Hardman, 1972; Ghosal et al., 1974; Bhatnagar et al., 1975; Kisclev and voloshina, 1975; Kisclev and voloshina et al., 1977; Kate et al., 1978; Reichelt and Cizek,1978; Varshney and Beg

1978; Gangrade and Kaushal, 1979; varshney and jain, 1979; Hardman and Elujoba, 1980; Hardman et al., 1980; Kisclev et al., 1980; Nowak et al,, 1980 Varshney and Jain, 1980; Baccou et al, 1983; Pasich et al., 1983a,b; Gupta et al., 1984; Gupta et al., 1985a,b Gupta et al., 1986; Kamal et al., 1987; Pundarikakshudu et al., 1989; Jaggi and Kapoor 1992; Rastogi and Kumar, 1992).

Cell cultures: Later, the cell cultures of this plant species were established and the work was extended to flavonoids (Uddin et al., 1977), alkaloids (Khanna and Jain, 1972; Antony et al., 1975; Radwan and Kobate, 1980) and steroidal sapogenins (khanna and Jain, 1973; Zefer and Qadry, 1977; Zambo and szilagyi, 1982). The importance of the mucilage and steroidal sapogenins of this plant species has been emphasized by totte and Vlietinck (1983).

Enhancement of compounds: With an aim to enhance the yield of bioactive compounds work on the use of fertilizers (Narayanan and Jain, 1978; Pareek and Gupta, 1981; Kozlowski et al., 1984), ascorbic acid (Bhavsar et al., 1983) and the effect of sowing, sow spacing an nitrogen level (singh and Nand 1984) on diosgenin content in T foenum-graecum has also been carried out, similarly the effect of various phytohormones such as 2,4-dichlorophenoxyacetic acid, morphactins, abscissic acid, Indole -3-acetic acid, Nephthaleneacetic acid and gibberellic acid on germination seedling growth enzymatic activities and various metabolites in this plant species has also been worked out (Hardman and Brain, 1971; Balasimha et al, 1976 Tayal and Gopal 1976; Megha and Laloraya 1978;Tayal et al., 1978, Anand and sharma 1984; Jain and Agrawal, 1986, 1987, 1988 a,b) Similar efforts were also made in cell cultures for the induction of sapogenins in *T. foenumgraecum* (Khanna et al., 1975; Brain and Lockwood, 1976, Lockwood and brain, 1976; Hardman and stevens, 1978).

Mutagens have remarkable potentialities of improving crops with regard to their chemical composition both qualitatively and quantitatively. In view of this work has also been attempted for the regulation of bioactive compounds using various mutagens in T. foenum-graecum, both in vivo and in vitro (laxmi et al., 1980; Bhusari et al., 1982 Jain and Agrawal, 1987a,b 1988; Jain 1978; Guezwoska et al., 1983; Jain and purohit 1988).

Industrial uses:

This plant species also finds a wide industrial application for its high mucilage content in the endosperm, which is of galactomannan type and due to its high viscosity, it is widely used in the food and pharmaceutical industries as emulsifying and /or thickening agent and in the treatment of furunoculosis (totte and vleitinck, 1983).

***T. Corniculata* L.**

Cultivation : It is commonly known as kasturi methi' and cultivated for flavouring purposes as a pot herb occurring in the western Himalayas, bihar and west Bengal but widely cultivated in other parts of India.

Morphology: It is much branches, Suberect, strongly scented and 30 cm or more tall. Its branches are glabrous, faintly ribbed, leaves pinnate, leaflets-3-foliolate, 1.25-2.0 cm long, obovate-cumeate, faintly incisodentate, flowers bright yellow in close racemes and the pods 1.2-2.0 cm long sickle-shaped and 4-8 seeded.

Medicinal Uses: Its fruits are bitter, astringent and styptic and applied to swellings and bruises (Kirtikar and Basu,

1935). The leaves are reported to be as good as spinach rich in phosphorus.

Chemistry: the seeds contain 5.2% fatty oil two nitrogrenous bases, choline and bataine, and sapogenins - diosgenin, gitogenin, tigogenin and yamogenin (Varshney and sood; 1969). Besides this, the neutral lipid (Nazir et al., 1983) and the presence of two new flavone –C-glycoside, Viz 6-8 di-b-D glucopyranosyl acacetin and its monoacetate in the seeds have also been reported from this plant species (seshadri et al., 1972). Antimicrobial activity of seedling callus of trigonella species has been studied and flavonoids as the active principles have been established (Khanna and staba, 1968; Khanna et al., 1971).

Out of the known species, though much attention has been paid to *T. foenum-graecum* followed by T. corniculata, nevertheless, there are a number of other species of this genus, known to occur as weeds but, needs more studies.

T. OCCULTA DEL.

It is a diffuse herb, generally found on the margins of canals and ponds, sometimes in the moist sand, flowers are axillary sessile and in clusters, Bo work has been carried out in this plant species, except the isolation and characterization of steroidal sapogenins from the seeds and tissue cultures (Jain, 1976; Jain et al., 1977). Leaves used as a vegetable and also used as a green fodder for sheep and horse, seeds used in diarrhea.

T. POLYCERATA L.

It is glabrous or slightly hariy, stem slender, diffuse of procument , flowers 2-4, Umbellate and pod glabrous, slightly flattened and curved.

Phytochemically , not much work has been carried out on this plant species except the effect of growth regulators on flavonoids and steroidal sapogenins from seeds plant parts and tissue culture (Kamal and Sharma, 1981).

T. INCISE ROYLE

Is found generally as a winter weed in the fields, often occurs in association with Medicago denticulate willd. It is a slender, prostrate and sub-erect or diffuse annual, leaflets obovate; flower yellow and pods sickle shaped but flat. Normally, the plants are picked up by the poorer class and used as vegetable, but the work on the chemistry or pharmacology of this plant species is lacking.

T. EMODI BENTH

The plants are nearly glabrous or pubescent, stem erect or nearly often robust, flowers in racemose, stalk prolonged in a short point and pods glabrous, flat straight and transversely veined, but no work has been carried out on this plant species.

T. GRACILIS BENTH

It is a glabrous plant, stem slender diffuse of procumbent; flowers in umbellate form, pods pubescent, flat straight and transversely veined, but no work has been carried out however, it is used as a green fodder.

T. PUBESCENS EDGEW

It is nearly glabrous or hariy, stem slender, diffuse or procumbent flowers in umbellate form and pods hairy, flat, straight and transversely veined.

T. carulea Ser., T. fischeriana Ser., *T. gladiata* boiss. And T. sibthorpi sibth. & Sm.

These plant species are very less known though reported as weeds and resemble to other species of the genus in the morphological characters.

Isolation and characterization of diosgenin, together with gitogenin and /or tigogenin have been investigated in the seeds of *T. carulea* T. fischeriana, *T. gladiata* and T. subthorpi (Bohannon et al., 1974).

From the above it is evident that the genus trigonella is not only important from agriculture but also medicinal point of view hence more consistent interdisciplinary approach is needed to find out the utilization of the yet undiscovered wealth which is likely to be present in this genus.

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