Chapter II

Review of Literature
Barmer district is situated in the extreme west part of Rajasthan. It is the second largest district in the State covering about 8.29% of its total area.

Most of the area under our investigation comes under the arid climate. The vegetation in the arid region is sparse, plants only xerophytic adaptation are able to survive themselves such type of vegetation is known as desert scrub. Plants of arid zone are good and potential source of nutritional and medicinal compounds. These plants serve as an important source of feed and food for livestock and human being.

The trees are commonly lacking, shrubs are the dominant features. Some of the perennial shrubs are Crotalaria burhia, Aerva persica, Fagonia indica, Euphorbia hirta, Leptadenia pyrotechnica etc.

The vegetation of this region shows various xeromorphic features like deep root, dry hard and rod like thick or fleshy stem. Leaves either absent or much reduced with coating of wax or hair to prevent excessive evaporation.

Plants of this region are good source of phytochemically important compounds like antimicrobial substances, alkaloids, flavonoids, glycosides, fatty oils and steroids etc. These active substances are present in storage organ of plant such as roots, leaves, bark and seeds etc.

Some important medicinal plants used in herbal drugs found in northwest Rajasthan are: Ashwagandha (Withania somnifera [Linn.] Dural), Atibala (Abutilon indicum [Linn.] Sweat.), Bala (Sida cordifolia Linn.), Dhamasa
(Fagonia indica Burm. f.), Dhatura (Datura stramonium Linn.), Gwarpatha (Aloe barbadensis Mill.), Gokhru (Tribulus terrestris Linn.). and Tumba (Citrullus colocynthis Linn.).

Medicinal plants have their values in substances present in various plant tissues. The more important of these substances are flavonoids, alkaloids, compounds of carbon, hydrogen and nitrogen. Besides these substances glucosides, essential and fatty oils, resins, gums, mucilage tannins are also of large use.

Macadam (1917) studied the trees and plants of Jaisalmer and Jodhpur district.

Blatter and Hallberg (1919-1921) studied the vegetation of North-West Rajasthan and enlisted the plants occurring in different areas and habitat with ecological description.

Joshi (1956) studied the vegetation of the Bikaner and its adjacent areas.

Nair and Joshi (1957) observed sand-dune vegetation of Pilani and its environs.

Sarup (1957) studied the common plants of Bikaner and its neighbourhood.

Sarup (1958) listed some common medicinal plants of Jaisalmer and its neighbourhood.

Rolla and Kanodia (1962) studied vegetation and ecology of interior parts of Barmer and Jaisalmer district.
Puri et al. (1964) published “The flora of Rajasthan” with short description on each species, which was critically reviewed by Gupta (1975).

Mertia and Bhandari (1980) have observed vegetational adaptations in the extreme arid regions of the Indian desert.

Parmar, Pandey, and Roy (1985) have also studies the vegetation of Bikaner district.

Shetty and Singh (1987) studied the flora of Rajasthan.

Gena and Sharma (1988) studied vegetation of Rajasthan and classified on the basis of habitats viz. (i) vegetation of sandy habitats (ii) vegetation of gravel habitats (iii) vegetation of rocky habitats (iv) vegetation of saline habitats and (v) vegetation of aquatic habitats.

Singh and Sidhu (1989) have reported an analysis of the flora of Bikaner (north-west Rajasthan) and observed ten largest families in this area like Poaceae, Fabaceae, Asteraceae, Cyperaceae, Amaranthaceae, Euphorbiaceae, Malvaceae, Convolvulaceae, Boraginaceae and Cucurbitaceae.

Bhandari (1990) enumerated 682 species belonging to 352 genera and 87 families of flowering plants of North-West Rajasthan with 50 species of plants reported first time from this region.

Bhandari (1995) studied the floral wealth and plant adaptation of the Indian desert and observed ten largest families like Poaceae, Fabaceae, Asteraceae, Cyperaceae, Convolvulaceae, Malvaceae, Acanthaceae, Euphorbiaceae, Cucurbitaceae and Scrophulariaceae among nearly 680 species.
consisting the Indian desert.

Singh and Pandey (1998) studied ethnobotanical aspects of plants growing in Rajasthan.

Awasthi (1999) studied plant diversity of Meghalaya describing the diversity of vegetation types, wild species, cultivated species/forms and their wild relatives.

Goel and Mitra (2000) studied the methods and approaches to the conservation of plant diversity in India.

Harsh (2002) has studied the phytodiversity of Kodamdesar Pond area of Bikaner district.

Sher Mohammed (2002) has reported some halophytes from salt affected areas of Western Rajasthan.

Godara (2002) has reported some halophytes from waterlogged area of I.G.N.P., Lunkaransar, Bikaner district.


Kapoor and Sharma (2013) have studied ethnomedicinal aspects of some medicinal plants of Hanumangarh district of Rajasthan.
Kapoor and Raghuvanshi (2013) have studied some antidiabetic ethnic plants of India.

Kapoor (2013) has studied anticancer herbal plants of Rajasthan Desert.

Kapoor and Arora (2014) have studied ethnomedicinal plants of Jaisalmer district of Rajasthan used in herbal and folk Remedies.

Kapoor et al. (2015) have studied ethnomedicinal plant species of the Rajasthan used in skin disorders.

Kapoor and Kumar (2015) have recently studied ethnomedicinal plants of Sirohi district of Rajasthan used in herbal and folk Remedies.

**Climatological Studies**

Rajasthan being the desert area, its climate varies monthly from arid to sub-humid to the west of the Aravallis, the climate is marked by low rainfall, extreme diurnal and annual temperature, low humidity and high velocity winds. In the east of the Aravallis, the climate is semi arid to sub humid marked by lower wind velocity and higher humidity and better rainfall.

Joshi (1956) reported the climate of the area is typical of the dry hot desert. The summer temperatures are high and the annual rainfall is low. The annual rainfall within the area does not exceed 352 mm and the maximum amount of rainfall is distributed in the month of June to August when the maximum temperatures are also high.

Krishnan and Thanvi (1982) studied the variability of rainfall and evaluation of major rainfall types in western Rajasthan.
Sen (1990) described climatic aspect and vegetation of Rajasthan with special reference to Jodhpur, Bikaner, Nagaur and Barmer districts.

Ritu (2001) studied the climatological aspects of Indira Gandhi Canal irrigated area of Bikaner district.

Godara (2002) studied the rainfall, humidity and temperature of waterlogged area of I.G.N.P. Lunkaransar, Bikaner district.

Sudan (2002) studied the rainfall, humidity and temperature of Bikaner and Churu districts.

Gaur (2002) studied the rainfall, humidity and temperature of Churu district.

Khatri (2005) studied the rainfall, humidity and temperature of Hanumangarh district.

Gir (2006) has studied the climatological aspects of waterlogged area of Hanumangarh district.

Khatri (2007) has studied the climatological aspects of Tal Chhapar Wild life Sanctuary of Churu district.

Singh (2008) has studied the climatological aspects of Jhunjhunu district.

Bansal (2009) has studied the climatological aspects of Sri Ganganagar district.

Swami (2009) has studied the climatological aspects of Sri Ganganagar district.
Arora (2010) has studied the climatological aspects of Jaisalmer district.

Lekhera (2012) has studied the climatological aspects of Jodhpur district.

Prajapat (2012) has studied the climatological aspects of Sikar district.

Bansal (2013) has studied the climatological aspects of Sri Ganganagar district.

Raghuvanshi (2013) has recently studied the climatological aspects of Chhatargarh and Kolayat sites of Bikaner district.

**Soil Analysis**

The soil may be defined as a natural body, synthesized in profile from a variable mixture of broken and weathered minerals and decaying organic matter, which covers the earth in a thin layer and which supplies, when containing the proper amount of air and water, mechanical support and, in part, substance for plants (Buckman *et al.*, 1964).

The soil is the medium where the plants are rooted and from where water and soil nutrients are taken up by the plant roots. The ecological significance of the soil medium cannot be underrated because of the biological activities that are carried on in soil and importance of the productivity of the underground parts of the plants. In fact a complex soil instead of being one thing is made up of several components. Soil is thus not merely a group of mineral particles; it has also biological system of living organisms as well as some other components. It is thus preferred to call it soil complex.
The soil can be considered as a biochemically weathered product of nature as a habitat for the growth of plants. The plants are completely dependent on the soils in which they grow for anchorage, water and mineral nutrients.

The soil found in the arid regions of north-west part of India in the states of Rajasthan and Haryana, is the area between the Indus river in the west and the Aravalli mountain in the east are described as desert soils.

The nature and type of the soil, forming at a particular place is largely governed by the nature of the parent material and its interaction with climate, topography and organisms. The physical nature of a soil depends upon its texture and structure.

The predominant soil the parent material has been the subject of discussion by various workers. Tamhane (1952) divided the soils of Rajasthan into two main groups taking Aravallis as a line of demarcation between the eastern and western Rajasthan.

The soil in western Rajasthan has been described by Ray Chaudhari et al. (1963) as “Desert soils” and “Grey brown soils”. The periodic variation in moisture in dunes in western Rajasthan was studied by Krishnan et al. (1966), while the changes in moisture in arid zone were observed by Abichandani et al. (1967). Roy and Sen (1968) and Mathur et al. (1972) classified the medium textured soil on the basis of rainfall as sierozems within 300-500 mm limit, red desert soil within 200-400 mm limit, and the light textured soil with less than
200 mm limit rainfall. The last category was called as desert soil.

Dhir (1977) studied soil of the western Rajasthan. In his study he considered characteristics and properties of the soil.

Johri et al. (1978) studied the manganese status of some soils of western Rajasthan.

Joshi and Dhir (1981) studied the distribution of different forms of copper and zinc in the soils of extremely arid part of western Rajasthan.

The characteristics soil fertility and physico-chemical aspects of dunes in western Rajasthan was studied by Dhir (1985), Aggarwal and Lahari (1981) and Chaudhary (1984) gave the genesis and characteristics of dune field soils of western Rajasthan.

Chaudhary (1988) gave the moisture characteristics of arid soils and their relationship with soil properties and mineralogy.

Kaushalya et al. (1990) described the morphology and texture of shifting sand in western Rajasthan, India. According to him longitudinal dunes which are almost stable are found in the Bikaner-Pugal-Chhattargarh area.

Dutta and Joshi (1994) studied the potassium status of the sandy plain soils of arid Rajasthan.

Acharya (1999) also reported the various mechanical, physical and chemical characteristics of soil of Bikaner district.

Khan et al. (1999) observed the physico-chemical properties i.e. EC, pH, CaCO$_3$, particle size distribution in relation to depth of soil of Rawatsar tehsil,
Jha (2000) analysed nitrogen, phosphorus and potash contents of the soil of Kurukshetra district.

Ritu (2001) has analysed soils of canal irrigated area of Bikaner district.

Shahid (2002) has observed various parameters of soils of different tehsils of Bikaner district.

Godara (2002) studied the various parameters of soils of waterlogged area of I.G.N.P. Lunkaransar, Bikaner district.

Sudan (2002) studied the various physico-chemical properties of soils of Bikaner and Churu districts.

Gaur (2002) has analysed soils of sand dune vegetation of Churu district.

Khatri (2005) studied the various mechanical, physico-chemical properties of soils of Hanumangarh district.

Gir (2006) has studied the mechanical, physico-chemical analysis of soils of waterlogged area of Hanumangarh district.

Khatri (2007) has studied the mechanical, physico-chemical analysis of soils of Tal Chhapar Wild life Sanctuary area of Churu district.

Singh (2008) has studied the mechanical, physico-chemical analysis of soils of Jhunjhunu district.

Bansal (2009) has studied the various mechanical, physico-chemical properties of soils of Nagaur district.
Swami (2009) has studied the various mechanical, physico-chemical properties of soils of Sri Ganganagar district.

Arora (2010) has studied the various mechanical, physico-chemical properties of soils of Jaisalmer district.

Lekhera (2012) has studied the mechanical, physico-chemical analysis of soils of Jodhpur district.

Prajapat (2012) has studied the mechanical, physico-chemical analysis of soils of Sikar district.

Raghuvanshi (2013) has recently studied the mechanical, physico-chemical analysis of soil of different sites at Chhatargarh and Kolayat of Bikaner district.

**Ethnomedicinal Aspects**

Since times immemorial plants have been a rich source for therapeutics. The earliest reference of the medicinal use of plants has been found in "Rigveda" (3500-1800 B.C.). In "Atharva Veda" we find the more varied use of drugs. It is the "Ayurveda" which is the ancient Indian system of medicines fully recognizes and utilizes the medicinal properties of plants. "Charak Samhita" is another earliest treatise on "Ayurveda" (600 B.C.) which lists a total of 341 plants and plant products following use in health management. "Susruta Samhita" also dealt with plants related to medicine.

In India the indigenous system of medicines namely Ayurvedic, Siddha and Unani have been in existence from several centuries. Apart from India
these systems are prevalent in Korea, China, Singapore, West Asia and many other countries.

The work of isolation of active principles from medicinal plants and characteristics can be traced to the beginning of 19th century. From crude drug Ma Huang (Ephedra Spp.) of China ephedrine was isolated in 1887 and later introduced as drug in 1925. Likewise from opium (Papaver somniferum) morphine was isolated in 1804 and introduced as drug in 1818. From cinchona spp. of Peru, quinine was isolated in 1820 and introduced as drug in 1825.

Large number of drugs from medicinal plants were discovered and introduced in modern pharmacopoeias during 1850-1950.

Now-a-days there is a tendency to develop safe and effective natural drugs, which are mainly of plant origin, growing all over the world. We now also have herbal remedies for modern diseases like cancer, hypertension and diabetes.

During the past, a number of books, monographs and treatises containing wealth of information on economic and medicinal plants of India have appeared. Some of the notable contributions are those of: Van-Rheed (1678-1703)- Hortus Malabaricus; Dymock (1883)- Vegetable Materia Medica of Western India; Watt (1889-1899)- Dictionary of Economic Plants of India; Dey (1896) - Indigenous Drugs of India; Kiritikar and Basu (1933) - Indian Medicinal Plants; Nadkarni (1926) - Indian Materia Medica; Robert (1932) - Vegetable Drugs of India; Chopra (1933) - Indigenous Drugs of India;

Medicinal plants of Rajasthan region are good source of phytochemically important compounds like antimicrobial substances, alkaloids and steroids etc. With the opening of new vistas of ethanomedicinal studies, the scope of ethnobotany has greatly enlarged both in the terms of its theoretical contributions to an understanding of plant human relationship, as
well as for the practical applications of the biological knowledge of tribal people in medicine, agriculture, health and industry.

Some arid zone medicinal plants have been studied for their ecological, ethnomedicinal and phytochemical aspects by Gaur (2002), Kapoor and Ranga (2005), Khatri (2005), Madan, (2005), Singh (2008), Bansal (2009) and Swami (2009).

Jain and Chauhan (2009) have studied the ethnomedicinal uses of 38 plant species employed by tribal people, growing in Pali district of Rajasthan.


Meena et al. (2010) have studied uses of some traditional ethnomedicinal plants of southern Rajasthan.

Meena et al. (2010) have studied some ethno-medicinal plants used by Garasia tribe of district Sirohi of Rajasthan.

Sharma et al. (2011) have studied on ethno-medicinal plants of Rajasthan.

Lekhera (2012) has studied on ethno-medicinal plants of Jodhpur district.

Prajapat (2012) has studied uses of some ethno-medicinal plants of Sikar district.

Kapoor (2013) has studied anticancer herbal plants of Rajasthan Desert.
Kapoor and Sharma (2013) have studied ethnomedicinal aspects of some medicinal plants of Hanumangarh district of Rajasthan.

Kapoor and Raghuvanshi (2013) have studied some antidiabetic ethnic plants of India.

Kapoor et al. (2013) have studied ethnomedicinal plant species of the Rajasthan used in liver disorders.

Kapoor et al. (2013) have studied ethnomedicinal plant species of the Rajasthan used in respiratory disorders.

Kapoor et al. (2013) have studied ethnomedicinal plant species of the Rajasthan used in sexual disorders.

Kapoor et al. (2013) have studied ethnomedicinal plant species of the Rajasthan used in rheumatic ailments.

Kapoor and Arora (2014) have studied ethnomedicinal plants of Jaisalmer district of Rajasthan used in herbal and folk Remedies.

Kapoor et al. (2015) have studied ethnomedicinal plant species of the Rajasthan used in skin disorders.

Kapoor and Kumar (2015) have recently studied ethnomedicinal plants of Sirohi district of Rajasthan used in herbal and folk Remedies.

**Nutritive Contents**

Live stocks and human beings principally depend upon plants for their source of nutrition. Herbs, shrubs and trees are rich in protein and minerals and provide supplementary feed. So, the phytochemical investigations of these
plants are necessary. The nutritive value of the terrestrial semi-arid zone plants have been worked out by many workers, however, the review on some prominent plant species has been presented here.

Tayal (1961) has reported the chemical composition, digestibility and nutritive value of Karad (*Dichanthium annulatum*) grass.

Mathur (1966) reported that the nutritive value of phog (*Calligonum polygonoides*) with regards to proteins is favourable, comparable with that of the common roughages which is usually used by camel. Sharma *et al.* (1966) reported that *Albizia lebbeck* is a good fodder. Karwasara (1966) studied variation in the nutritive contents of Sewan grass (*Lasiurus sindicus*) and its feeding value of sheep.

Majumdar *et al.* (1967) studied 17 species of tree leaves and concluded that, specially during early stage of growth, the leaves are rich in Crude Protein and Calcium. Gupta (1967) determined the nutritive value of *Prosopis cineraria*.

Purohit and Mathur (1970) have reported the nutritive value of Murat grass (*Panicum turgidum*).

Patel *et al.* (1971) observed that *Cassia tora* pods can be used in cattle ration at the rate of 10 per cent. Bhandari (1974) reported the nutritive value of some fodder plants for livestock in Rajasthan.

Ganguli *et al.* (1974) reported that leaves of *Acacia nilotica* are an excellent fodder and are extensively used for this purpose.
Purohit et al. (1976) studied the effect of water restriction on dry matter intake and digestibility of nutrients in pure and cross bread Marwari sheep.

Bhatty et al. (1979) studied the carbohydrate containing polymer from Cordia myxa. Mathur (1978) determined the chemical composition and nutritive value of Gudera (Themeda quadrivalvis).

Bhandari et al. (1979) reported the chemical composition and nutritive value of Khejri (Prosopis cineraria).

Gaur (1979) determined the chemical composition and gross energy content of two important desertic shrubs Phog (Calligonum polygonides) and Bui (Aerva pseudotomentosa). Mathur and Purohit (1979) determined the nutritive value of Bekaria (Indigofera cordifolia), a leguminous plant species and found that it contained about 7 to 8 percent crude protein. Nag et al. (1979) conducted phytochemical studies of different plant parts of three plant spp. Tribulus alatus, T. terrestris and Agave wightii. Sankhla and Sankhla (1979) determined the soluble protein content of some of the feed and reported that odour, taste, colour and cyanogenic glucosides also play a part in animal feeding at least partially.

Subabul (Leucaena leucocephala) is a promising highly nutritive, exotic fodder tree which is recently established in Rajasthan. The chemical composition and nutritive value have been studied by Kharat et al. (1980), Deshmukh et al. (1983), Dharamraj et al. (1985), Virk et al. (1985), Arora and Purohit (1986) and Shyam (1987).
Harsh et al. (1981) studied nutritive value of dried terrestrial plants growing in Rajasthan.

Sethia et al. (1987) studied the nutritive status of *Heliotropium marifolium* and *Heliotropium rarifolium* (Boraginaceae). The maximum amounts of crude protein (14.5%) and ash (16.8) in leaves, crude fibre (53.07%) in root and calcium (7.80%) in leaves were found in *H. rarifolium* while crude fat (7.86%), nitrogen free extract (49.48%) and phosphorus (0.1247%) were found maximum in the leaves of *H. marifolium* on dry weight basis.

Mathur et al. (1988) estimated the proximate composition of different parts of three arid zone plants i.e. *Blepharis sindica*, *Glinus lotoides* and *Zaleya redimita*.

Kapoor et al. (1988) and Kapoor (1991) studied nutritive content value of some arid zone plants of western Rajasthan.

Saxena et al. (1989) reported the nutritive value of *Calligonum polygonoides* and found that in the drought condition it can be utilized as fodder substitute for livestock in the desert. Singh et al. (1989) determined the chemical composition and nutritive value of Siris (*Albizia lebbeck*) and Subabul (*Leucaena leucocephala*). Chemical investigation of *Indigofera oblongifolia* was done by Lodha et al. (1990).

Bishnoi and Gautam (1991) studied the chemical composition of shoots and seeds of *Calligonum polygonoides*. Kapoor (1991) has reported the
nutritive contents from different parts of *Fagonia cretica* and *Aerva tomentosa* and suggested to them as forage for cattle. Harsh and Arora (1993) estimated the nutritive value of *Citrullus fistulosus*. Patel *et al.* (1993) estimated the chemical composition of some Ber leaves growing in arid zone area of Rajasthan.

Acharya (1993) has reported nutritive contents from different parts of *Cordia gharaf* and *Cordia dichotoma*.

Rajput and Sen (1993) estimated the nutritive values and minerals of *Atriplex spp.* in Indian desert.

Nutritive status of *Maytenus emarginata, Parkinsonia aculeata* and *Tecomella undulata* were studied by Harsh and Ahmed (1994).

Harsh and Ahmed (1995) observed nutritive contents in two terrestrial plant species growing in Rajasthan.

Mathur and Jindal (1996) estimated the nutritive and moisture contents in *Fagonia indica, Corchorus depressus* and *Oligochaeta ramosa*.

Acharya (1999) has estimated the nutritive values of some arid zone plants of western Rajasthan.

Harsh and Maheshwari (2000) analysed nutritional status of *Capparis decidua, Crotalaria burhia* and *Ziziphus mauritiana* collected from Bikaner district, Rajasthan.

Kapoor and Ritu (2001) have observed the nutritive values of some trees of western Rajasthan.
Maheshwari (2001) reported the nutritive value of some arid zone plants of Bikaner, western Rajasthan.

Ritu (2001) estimated the nutritive value of some newly introduced plant species growing in Indira Gandhi Canal irrigated area of Bikaner district.

Harsh (2002) reported the nutritive value of *Abutilon indicum*, *Aerva persica*, *Euphorbia microphylla* and *Glinus lotoides* growing in Kodamdesar Pond area of Bikaner district.

Ranga (2002) reported the nutritive value of *Pulicaria crispa*, *Xanthium strumarium*, *Launea procumbens* and *Sonchus asper* growing in Harsholow Pond area of Bikaner district.


Kapoor *et al.* (2004) reported the nutritional value of *Abutilon indicum*, *Barleria prionitis* and *Solanum nigrum*.

Kapoor *et al.* (2004) reported the nutritional status of some arid zone tree species.

Khatri (2005) reported the nutritive value of medicinal plants *Abutilon indicum*, *Barleria prionitis* and *Solanum nigrum* growing in different areas of Hanumangarh district.

Gir (2006) has estimated the nutritive status of some halophytic plants of waterlogged area of Hanumangarh district.

Khatri (2007) estimated the nutritive status of some plant species of Tal
Chhapar Wildlife Sanctuary of Churu district.

Arid zone plants have been studied for their nutritive status by many workers like Singh (2008), Soni (2008), Acharya (2009), Mishra (2009), Bansal (2009), Swami (2009), Arora (2010), Pandita (2012), Lakhera (2012), Prajapat (2012) and Purohit (2012).

Kapoor and Kumar (2015) have recently estimated the nutritive value of medicinal plants *Butea monosperma, Cassia fistula* and *Madhuka indica* growing in different areas of Sirohi district of Rajasthan.

**Mineral Contents**

Minerals are also a type of nutritive contents which constitute major part of animal diet. Some of these are important in various metabolic activities also.

The mineral contents in various arid zone plants have been studied by Mathur, Karwasra (1967); Purohit and Mathur (1970); Nag et al. (1979); Harsh et al. (1980); Grover and Nag (1984).

Sethia et al. (1987) reported 0.124% phosphorus in leaves of *Heliotropium marifolium* and 7.80% calcium in leaves of *Heliotropium rarifolium*.

Kapoor et al. (1988) reported mineral contents (Calcium and Phosphorus) in various plant parts of *Zaleya redimita, Glinus lotoides* and *Blepharis sindica*.

Kapoor et al. (1988) estimated the mineral contents (Calcium and
Phosphorus) in roots, shoots and fruits of *Aerva tomentosa*.

Kapoor (1991) estimated Phosphorus and Calcium in different parts of *Fagonia cretica* and *Aerva tomentosa*.

Harsh and Ahmed (1995) estimated calcium and phosphorus from two terrestrial plant species growing in Rajasthan.

Khodke and Gahukar (1998) reported the phosphorus contents in Chilli fruits.

Harsh and Maheshwari (2000) observed calcium and phosphorus contents in some arid zone plants of Bikaner, Rajasthan.

Kapoor and Ritu (2001) reported the calcium and phosphorus from leaves of *Moringa oleifera, Pithecellobium dulce* and *Pongamia pinnata*.

Maheshwari (2001) estimated phosphorus and calcium in different parts of *Crotalaria burhia, Capparis decidua* and *Ziziphus mauritiana* in different seasons.

Shahid (2002) reported the mineral status (Potassium and Calcium) in roots shoots and fruits of *Acacia nilotica, Acacia senegal, Maytenus emarginata, Parkinsonia aculeata* and *Prosopis cineraria*.

Ranga (2002) reported the mineral status (Sodium, Phosphorus, Potassium and Calcium) in roots, shoots and fruits of *Launaea procumbens, Pulicaria crispa, Sonchus asper* and *Xanthium strumarium*.

Godara (2002) reported the mineral contents (Na, K, Ca, P) in roots, shoots and fruits of some halophytes plant species *Chenopodium murale,*
*Haloxylon recurvum, Salsola baryosma* and *Suaeda fruticosa*.


Khatri (2005) reported the mineral contents (calcium, phosphorus, sodium, potassium) in roots, shoots and fruits of some medicinal herbal plants *Abutilon indicum, Barlaria prionitis* and *Solanum nigrum*.

Gir (2006) has estimated the mineral contents of some halophytic plants of waterlogged area of Hanumangarh district.

Khatri (2007) has estimated the mineral contents of some plant species of Tal Chhapar wildlife Sanctuary of Churu district.

Singh (2008) has studied the mineral contents from some plant species growing in Jhunjhunu district.

Soni (2008) has evaluated the mineral contents from some arid tree species growing in Bikaner district.

Arya *et al.* (2009) have estimated the mineral contents from some halophytes of western Rajasthan.

Elhassan *et al.*, (2010) evaluated the mineral contents of fruits of *Grewia* species.

Swami (2009), Lakhera (2012) and Prajapat (2012) have estimated the mineral content of arid zone plants of western Rajasthan.
Kapoor and Mishra (2013) estimated the mineral contents from some Cappridaceous plant species of north-west Rajasthan.

Kapoor and Acharya (2013) evaluated the mineral contents from some Tiliaceous plant species of arid region of Rajasthan.

Kapoor and Pandita (2013) evaluated the mineral contents from some exotic tree species of Rajasthan desert.

Kapoor and Purohit (2013) estimated the mineral contents from some Fabaceous plant species of Rajasthan desert.

Kapoor and Bansal (2013) evaluated the mineral contents from some tree species of Nagaur district of Rajasthan.

Kapoor and Arora (2014) estimated the mineral contents from some medicinal plant species of Jaisalmer District of Rajasthan.

Kapoor and Kumar (2015) have recently estimated the mineral contents from some medicinal plant species like *Butea monosperma, Cassia fistula* and *Madhuka indica* growing in Sirohi district of Rajasthan.

**Amino Acid Contents**


Bhushan (1981) has identified free amino acids and sugars in plant tissue by paper chromatography.


Rai (1987) have reported that few species of Capparis decidua, Citrullus colocynthis, Citrullus lanatus, Ziziphus mauritiana and Ziziphus nummularia and Sorghum halepense can be used as emergency famine foods, in his paper entitled chemical examination of edible parts in Rajasthan desert.

Amino acids composition has also been detected in cobra plant (Bhatty et al., 1979); Amaranthus spp. (Correa et al., 1988); Lagenaria vulgaris seed (Joshi and Srivastava, 1981); Fagonia indica (Khan et al., 1979); Dioscorea tubers (Kouassi et al., 1988).

High amino acid contents have also been reported in germinated seeds of fodder plants (Kina, 1988), leguminous plants (Prakash et al., 1987).

Otchere et al. (1988) estimated amino acids in seeds of Griffonia simplicifolia (a leguminous shrub) by HPLC technique from Accra plains. They concluded that the amino acids threonine and tyrosine contents were similar while histidine, arginine, methionine and isoleucine contents were
about two third the contents in soyabeans.

Gomes et al. (1988) have reported that the chemical composition of seeds of *Canavalia brasiliensis* was similar to that of other legume seeds. Non-protein amino acids constituted 35% of total nitrogen and the amino acid profile showed 17% canavanine. Limiting amino acids were methionine and cystine. Prakash et al. (1988) studied amino acid profiles of some underutilized seeds produced in India. Currently going to waste showed that some could be used for cattle or poultry feed or for human consumption after removal of any toxins. Data on contents of total protein and of 17 amino acids are tabulated, most species such as *Luffa echinata*, *Cardiospermum halicacabum* and chick pea were low in cystine and methionine and would need supplementation with other protein seeds of *Aesculus punduana*, *Corchorus olitorius* and *Lobelia leschenantiana* however could be used to supplement diets poor in lysine.

Sinha and Saran (1988) detected various amino acids and protein contents of leaves in *Panicum spp.* by using two dimensional chromatography techniques. The detection, identification and quantitative estimation of free amino acids in young leaves of *Panicum miliaceum*, *P. sumatrense*, *P. maximum*, *P. repens* and *P. coloratum* have been carried out by them. Leaves of *P. miliaceum* contained the highest amount of total amino acids, *P. maximum* leaves had the highest content of essential amino acids and crude protein while *P. repens* had the lowest crude protein content.
Lefevre et al. (1989) concluded that the values for glutamine and asparagin in stubble and roots of Lolium perenne (perennial rye grass) were twice than those of leaves. They estimated free amino acids more in stubble root and leaves by HPLC technique.

Joshi and Kumar (1993) found the quantitative estimation of glutamic acid, glycine, isoleucine, leucine, methionine, phenyl alanine, serine, threonine and valine in different parts of Salvadora persica. They concluded that these amino acids were increased in amount in salinity conditions. While arginine, alanine, aspartic acid and asparagine were decreased in salinity.

Bains and Harsh (1996) have reported the 13 free and 11 bound amino acids from various plant parts (Root, shoot and fruit) of Citrullus lanatus and Withania somnifera.

Kubota et al. (1998) estimated the two natural amino acids, (R₅)-3-[(methylthio) methylsulfinyl]-L-alanine and S-[(methylthio) methyl]-L-cysteine. They were isolated from the fruit of Scorodocarpus bornensis which was known to have garlic like odour.

Acharya (1999) reported free and bound amino acids from various plant parts (stem, leaf and fruits) of some arid zone trees.


Maheshwari, (2001) reported free and bound amino acids from various plant parts (roots, shoots and fruits) of Crotalaria burhia, Capparis decidua and Ziziphus mauritiana.
Ritu (2001) estimated the 18 free and 13 bound amino acids from various plant parts (roots, shoots and fruits) of *Heliotropium curassavicum*, *Parthenium hysterophorus* and *Lantana camara* collected from Indira Gandhi Canal irrigated area of Bikaner district.

Harsh, (2002) has reported 18 free and 15 bound amino acids from various plant parts (root, shoots and fruits) of *Abutilon indicum, Aerva persica, Euphorbia microphylla* and *Glinus lotoides* growing in Kodamdesar Pond area of Bikaner district.

Godara, (2002) reported 17 free and 14 bound amino acids from various halophytes plant parts (roots, shoots and fruits) of *Chenopodium murale, Haloxylon recurvum, Salsola baryosma* and *Suaeda fruticosa* growing in waterlogged area of I.G.N.P. Lunkaransar, Bikaner.

Kapoor *et al.* (2003) reported the production of free and bound amino acids from some arid zone Asteraceous medicinal plants.

Harsh and Kapoor (2004) observed free and protein bound amino acids in some arid zone plants like *Abutilon indicum, Aerva persica, Euphorbia microphyllus* and *Glinus lotoides*.

Khatri, (2005) observed 14 free and 14 bound amino acids from various medicinal plant parts (roots, shoots and fruits) of *Abutilon indicum, Barlaria prionitis* and *Solanum nigrum* growing in different areas of Hanumangarh district.

Gir (2006) has reported 18 free and 15 bound amino acid contents from
various parts of some halophytic plants of waterlogged area of Hanumangarh district.

Khatri (2007) has reported the amino acid contents from some plant species of Tal Chhapar wildlife Sanctuary of Churu district.

Singh (2008) has studied the amino acid contents from some plant species growing in Jhunjhunu district.

Soni (2008) has evaluated the amino acid contents from some arid tree species growing in Bikaner district.

Arid zone plants have been studied for their amino acid contents by many workers like Acharya (2009), Mishra (2009), Bansal (2009), Swami (2009), Arora (2010), Pandita (2012), Lakhera (2012), Prajapat (2012) and Purohit (2012).

Parmer et al. (2013) reported the free amino acid contents from Achyranthes aspera.

Yadav et al. (2014) recently reported amino acid contents from Swertia chirata.

Ascorbic Acid Contents

Ascorbic acid is an important regulator of oxidation and plays significant role in germination, growth, metabolism and flowering in plants. There are considerable evidences of the role of ascorbic acid in oxidative phosphorylation and its importance for the animal health. There are several reports on ascorbic acid contents from plants viz. Aberg (1958); Chinoy (1962,

All actively growing and differentiating organ show higher concentration of ascorbic acid and it is constantly utilized enzymatically (Chinoy, 1962; Chinoy et al., 1967).

Ascorbic acid has also been reported from leaves of Lycium chinense (Mizobunchi et al., 1969), seeds of Cicer arietinum (Chandra and Arora, 1968), Citrullus colocynthis and Corchorus depressus (Nag and Harsh, 1983), Peganum harmala, Seetzenia orientalis, Tribulus alatus, T. terrestris, Zygophyllum simplex (Nag et al., 1986) and fruits of Artocarpus integrifolia (Singh, 1985) and intact parts of Abutilon pannosum and Ocimum americanum (Singh 1989).

Ascorbic acid increased in fruits of cultivars during ripening and was highest at all stages in L-22 fruits. Vine ripened fruits had higher ascorbic acid contents than fruits ripened off the vine. Diaz and Lvon (1987) postulated after considerable studies on oranges of chilean variety Citrus sinensis and its variation in the Vitamin-C contents during the harvesting period that the ascorbic acid in juice at beginning and end of the season reached 60.7 and 70 mg/100g. with peak at end of August corresponding values in pulp were 20.4 and 36.6 in membranes 17.5 and 20.1 and in albedo 1.4 and 1.6 mg/100g.

Kapoor (1989) reported free endogenous ascorbic acid from various
parts of *Argemone mexicana* growing in arid zone of Rajasthan.

Mushi and Mondy (1989) have reported ascorbic acid and protein content of potatoes (*Solanum tuberosum*). Ketsa and Khan (1987) studied the ascorbic acid concentration in maturity stages of tomato (*Lycopersicum esculentum*).

Singh *et al.* (1990) have reported the ascorbic acid from some arid zone plants of Rajasthan.

Sukhadia (1993) has reported ascorbic acid in the developing embryos of *Commelina* and *Ceratophyllum*.

Bhatt *et al.* (1998) estimated the concentration of ascorbic acid in *Lycopersicum esculentum*.

Acharya (1999) analysed the ascorbic acid concentration from different plant parts of some trees growing in arid zone of Rajasthan.

Chaturvedi *et al.* (2000) estimated the ascorbic acid concentration in different strains of cucumber (*Cucumis sativus*).

Kapoor and Ritu (2000) estimated free endogenous ascorbic acid from different parts of some arid zone trees of western Rajasthan.

Ritu (2001) analysed the ascorbic acid concentration from different plant parts of some newly introduced plant species growing in Indira Gandhi Canal irrigated area of Bikaner district.

Maheshwari (2001) estimated free endogenous ascorbic acid from *Crotalaria burhia, Capparis decidua* and *Ziziphus mauritiana* in different
seasons. Maximum ascorbic acid content (140 mg/100g.d.w.) was found in fruits of *Ziziphus mauritiana* in winter season and minimum (63 mg/100g.d.w.) in roots of *Capparis decidua* in summer season.

Harsh (2002) has analysed ascorbic acid from *Abutilon indicum, Aerva persica, Euphorbia microphylla* and *Glinus lotoides* growing in Kodamdesar Pond area of Bikaner district.

Ranga (2002) has analysed ascorbic acid from *Pulicaria crispa, Xanthium strumarium, Launea procumbens* and *Sonchus asper* growing in Harsholow Pond area of Bikaner district.

Godara (2002) has analysed ascorbic acid from some halophytes *Chenopodium murale, Haloxylon recurvum, Salsola baryosma* and *Suaeda fruticosa* growing in waterlogged area of I.G.N.P. Lunkaransar, Bikaner.

Kapoor and Ranga (2003) analysed the ascorbic acid contents of some asteraceous medicinal plants of Rajasthan desert.


Kapoor *et al.* (2004) analysed the ascorbic acid contents from different plant parts of some arid zone plants like *Abutilon indicum, Barleria prionitis* and *Solanum nigrum*.

Kapoor *et al.* (2005) estimated the ascorbic acid contents in different plant parts of some arid zone tree species.

Khatri (2005) has analysed ascorbic acid from *Abutilon indicum,
Barlaria prionitis and Solanum nigrum growing in different sites of Hanumangarh district.

Gir (2006) has reported the ascorbic acid contents from various parts of halophytic plants of waterlogged area of Hanumangarh district.

Khatri (2007) has evaluated the ascorbic acid contents from some plant species of Tal Chhapar Wildlife Sanctuary of Churu district.

Singh (2008) has studied the ascorbic acid contents from some plant species growing in Jhunjhunu district.

Goswami et al. (2008) have studied the ascorbic acid contents in some medicinal plants in vivo and in vitro.

Soni (2008) has evaluated the ascorbic acid contents from some arid tree species growing in Bikaner district.

Arya et al. (2009) have evaluated ascorbic acid contents in some halophytic plants of western Rajasthan.

Kapoor and Pandita (2013) analyzed the ascorbic acid contents from some exotic tree species growing in Rajasthan desert.

Kapoor and Mishra (2013) estimated the ascorbic acid contents in Capparidaceous medicinal plants of north-west Rajasthan.

Kapoor and Bansal (2013) evaluated the ascorbic acid contents form some medicinal tree species of Nagaur district of Rajasthan.

Kapoor and Purohit (2013) analyzed the ascorbic acid contents from some Fabaceous plant species growing in Rajasthan desert.
Kapoor *et al.* (2013) evaluated the ascorbic acid contents from some medicinal plant species of the Jaisalmer district of Rajasthan.

Kapoor *et al.* (2013) estimated the ascorbic acid contents from some medicinal plant species of Jhunjhunu district of Rajasthan.

Kapoor and Lakhera (2013) analyzed the ascorbic acid contents from some medicinal plant species of the Jodhpur district of Rajasthan.

Kapoor *et al.* (2014) evaluated the ascorbic acid contents from some medicinal tree species of Sikar district of Rajasthan.

Kapoor and Kumar (2014) recently estimated the ascorbic acid contents from some medicinal tree species of Sirohi district of Rajasthan.

**Secondary Metabolites**

Biosynthesis of secondary metabolites from intact plant parts has gained increasing attention over the years. Presence of various compounds and their uses has extensively been emphasized by number of workers like Batesmith, 1969; Kapoor *et al.*, 1971; Syono, 1973; Kruse and Patterson, 1973; Reinhard, 1974, 1975; Dixit, 1977 and Collens, 1987.

Plants of semi-arid zones are considered to be rich medicinally but there is not enough data to prove whether these ecological conditions are optimal to the synthesis of secondary metabolites. Arid zone climate consists of not only drought but also high temperature due to lack of rains. The interaction of these two factors affects the plants adaptability to its environment and a few examples of adaptable medicinal plants supports the concept of a beneficial
influence of dry conditions on the production of secondary metabolites (Paris and Dillemann, 1960) which include *Ephedra, Echinocactus, Duboisia, Hyoscyamus, Peganum* and *Anabasis*.

Higher plants produce a great variety of secondary products which play a minor role in the basic life processes of the plant but often have an ecological role, such as attractant of pollinators and chemical defense against microorganisms, insects and higher predators (Wink, 1988). Many of these natural products have been used as sources of large number of industrial products, including agricultural, chemicals, pharmaceuticals and food additives. Although, some of the natural products have been replaced by synthetic substitutes because of cost considerations, a number of commercially important high value chemicals are still being extracted from plants (Sauerwein et al., 1992; Misawa, 1994).


In ethnomedicinal plants secondary metabolites was reported by many workers like Sagwan et al. (2010); Elhassan et al. (2010); Gupta et al. (2010); Dhale et al. (2010); Kalaiarasan et al. (2010); Ahmed et al. (2011); Sughuna et al. (2011); Sarma et al. (2011); Omogbai et al. (2011); Samejo et al. (2011);
Kapoor and Mishra (2013) recently reported the Sterol Contents from some Capridaceous medicinal plants of north-west Rajasthan.

Kapoor and Kumar (2014) studied flavonoid contents from some medicinal tree species of Sirohi district of Rajasthan.

Yadav et al. (2014) recently reported secondary metabolites in six medicinal plants used in traditional medicine.

Some of the plants are rich in secondary metabolites which are potential source of drug and essential oils. Biosynthesis of metabolites although controlled genetically is affected strongly by environmental influence. As a result, there are fluctuations in the concentrations and quantities of secondary metabolites such as antimicrobials, flavonoids, phytosterols, steroidal sapogenins and pyrethrins etc.

**Antimicrobial Screening**

A number of plants have been screened for their antimicrobial activity. The antimicrobial principles and their distribution have extensively been reviewed by Skinner (1955) followed by Nickell (1959) who surveyed 174 plants belonging to 157 families of vascular plants. Su Lee et al. (1972) have
screened aquatic plants from Minnesota for their antimicrobial property and have found many plants active against selective microorganisms.

Harsh (1982) and Kapoor 1991 observed antimicrobial activity of plant parts and tissue cultures of some medicinal arid zone plants of western Rajasthan.

Harsh and Nag (1988) observed flavonoids with antimicrobial activities in some arid zone plants.

In vitro antimicrobial activity of Acacia arabica was reported by Chandel et al. (1993). Antifungal activities from leaves of Acacia nilotica against Pythium apheridermatum have been reported by Khan et al. (1996). The aerial parts of Pulicaria crispa, growing wild in Saudi Arabia, a volatile oil were extracted. The activity of the oil on several microorganisms (Staphylococcus aureus, Bacillus subtilis, Escherichia coli, Proteus vulgaris and Candida albicans) was investigated (Hassan et al., 1989).

Akhtar et al. (1997) reported the antimicrobial activity of plant decoctions against Xanthomonas campestris on detached citrus leaves. Antibacterial activity of plant diffusate against Xanthomonas campestris is also reported by Akhtar et al. (1997). Turkusay and Onogal (1998) studied the antifungal effects of leaf extracts of Allium sativa, Xanthium strumarium, Ficus carica, Nicotiana tobacum and Datura stramonium against Alternaria alternata, Alternaria solani and Botrytis cinerea.

The antimicrobial activity from twigs and leaves of four Chilean species
of Pseudognaphatium; P. robustum, P. heterotrichium, P. viravira and P. cheiranthifolium were studied by Mendoza et al. (1997). Tereschuk et al. (1997) studied antimicrobial activity and flavonoids from the leaves of Tagetes minuta.

Antimicrobial activities of extracellular secondary metabolites of local and international Fusarium species were screened by Mandeel et al. (1999). Antimicrobial activity and flavonoids from leaves and flowers of Adhatoda vasica Nees was observed by Ahmed-El-Sawi et al. (1999).

Khan et al. (2001) studied the antimicrobial activity from methanolic extracts of Castanopsis acuminatissima leaves, stem and root barks. Ethanolic extracts of 45 Indian medicinal plants traditionally used in medicine were studied for their antimicrobial activity against certain drug resistant bacteria and a yeast Candida (Ahmed and Beg-Arina, 2001). Kostava (2001) studied the antimicrobial activity and isolate the flavonoid contents from the bark, leaves and flowers of Fraxinus ornus.

Ranga (2002) studied the antimicrobial activity of leaves of Pulicaria crispa, Xanthium strumarium, Launea procumbens and Sonchus asper growing in Harsholow Pond area of Bikaner district, against Staphylococcus aureus, Escherichia coli and Candida albicans.

Shahid (2002) studied the antimicrobial activity of leaves and flowers of Acacia nilotica, Acacia senegal, Maytenus emarginata, Parkinsonia aculeata and Prosopis cineraria against Staphylococcus aureus, Escherichia coli and
*Candida albicans.*

Deokule and Patale (2002) conducted the pharmacognostic study of *Abutilon indicum* Linn.

Annie Shriwalkar *et al.* (2003) observed protective effect of *Pongamia pinnata* flowers against cisplatin and gentamicin induced nephrotoxicity in rats. Ethanolic extract of flowers had a marked nitric oxide free radical scavenging effect, suggesting an antioxidative property. Two flavonoids viz. kaempferol and 3,5,6,7,8 penta methoxy flavone were isolated from the extract.

Sarada and Rao (2003) investigated that essential oil of *Lippia nodiflora* showed more antimicrobial activity against *E. coli, Streptococcus lactis, Bacillus subtilis* and *Lactobacillus bulgaricus.*

Qamaruddin *et al.* (2003) reported antifilarial potential of the fruits and leaves extracts of *Pongamia pinnata* on cattle filarial parasite *Setaria cervi.*

Raju *et al.* (2001) reported the effect of dried fruits of *Solanum nigrum* Linn. against CCL-4 induced hepatic damage in rats.

Rashid *et al.* (2003) reported constituents of *Albizia lebbeck* and antimicrobial activity of an isolated flavone derivative.

Odetola *et al.* (2004) investigated that fresh, ripe fruits of *Solanum melongena* and *Solanum gilo* had strong hypolipidemic effect which is an indication of the possible use of these fruits in the treatment of diseases associated with hyperlipidaemia.

Mishra and Mishra (2004) evaluated that out of bark oil and leaf oil of
Cinnamomum zeylanicum, bark oil was found to have more antimicrobial activity against E. coli, Streptococcus aureus, Salmonella senftenberg, Vibrio cholerae.

Indira and Rajalakshmi (2004) conducted the research on screening of phytochemical, antimicrobial and hypoglycemic activity of Eugenia jambolana.

Sujatha and Sandhya (2005) tested the antimicrobial activity of Syzygium aromaticum and Millingtonia hortensis against E. coli, C. albicans, S. aureus and Pseudomonas spp.

Khatri (2005), Madan (2005), Rao (2007), Singh (2008) and Soni (2008) have observed the antimicrobial activity of some arid zone plants against S. aureus, E. coli and C. albicans.

In medicinal plants antimicrobial activity was reported by many workers like Sagwan et al. (2010); Elhassan et al. (2010); Gupta et al. (2010); Dhale et al. (2010); Kalaiarasan et al. (2010); Abdel-Aziz et al. (2010); Ahmed et al. (2011); Sughuna et al. (2011); Sarma et al. (2011); Omogbai et al. (2011); Samejo et al. (2011); Darabpour et al. (2011); Kapoor et al. (2011); Valarmathi et al. (2012); Shareef et al. (2012); Suresh et al. (2012); Jogi et al. (2012); Sridhar et al. (2012); Patter et al. (2012); Agilandeswari (2012); Parveen et al. (2012); Mallam. et al. (2012); Kapoor et al. (2012); Madhavan et al. (2013); Indhumol et al. (2013); Marzouk et al. (2013); Parmer et al. (2013); Sharma et al. (2013); Wake et al. (2013).
Kapoor and Mishra (2013) studied the antimicrobial activity of some arid herbal plants of Rajasthan.

Kapoor and Mishra (2013) studied the antimicrobial activity of some Capparidaceous medicinal plants of north-west Rajasthan.

Kapoor and Pandita (2013) studied the antimicrobial activity of some exotic tree species of Rajasthan desert.

Kapoor and Purohit (2013) studied the antimicrobial activity of some Fabaceous plant species of Rajasthan desert.

Kapoor et al. (2013) studied the antimicrobial activity of some medicinal plant species of Jhunjhunu district of Rajasthan.

Kapoor and Bansal (2013) studied the antimicrobial activity of some medicinal tree species of Nagaur district of Rajasthan.

Kapoor et al. (2013) studied the antimicrobial activity of some medicinal plant species of the Jaisalmer district of Rajasthan.

Kapoor and Lakhera (2013) studied the antimicrobial activity of some medicinal plant species of the Jodhpur district of Rajasthan.

Kapoor et al. (2014) studied the antimicrobial activity of some medicinal tree species of Sikar district of Rajasthan.

Kapoor and Kumar (2014) recently studied the antimicrobial activity of some medicinal tree species of Sirohi district of Rajasthan.

**Flavonoid Contents**

Researches on flavonoids have been conducted both *in vivo* and *in vitro*.
tissue cultures. Kaempferol, quercetin, isohamentin, herbacetin, B-methyl ether have been reported from Zygophyllaceous arid zone plants viz. *Fagonia arabica*, *Seetzenia lantana*, *Tribulus longipetalus*, *T. terrestris*, *Zygophyllum album*, *Z. simplex* and *Nitraria retusa* (Saleh and Hadidi, 1977). Free quercetin along with bound kaempferol in leaves and flowers of *Citrullus colocynthis*, *C. depressus*, *Fagonia cretica* and *Lycium barbarum* and tissue culture of *Peganum harmala* have been reported (Harsh, 1982).

In the flavonoid contents of *Stevia neptifolia*, quercetin was found to be the major glycoside (Rajbhandari and Roberts, 1984). Spanish peanut *Arachis hypogea* also contains dehydro-quercetin (Pratt and Miller, 1984). Pathak and Manral (1987) have reported 3-flavone c-glycosides and a flavonol identified as isovitexin from the leaves of *Polygonum amplexicaule*. Mathur, Kavita (1988) reported quercetin and kaempferol from the leaves and fruits of *Bergia odorata*, *Eclipta alba* and *Zygophyllum simplex*. Kapoor (1991) has isolated qualitatively and quantitatively quercetin and kaempferol from tissue cultures of *Fagonia cretica*.


Isolation and structure elucidation was carried out of flavonoid
constituents found in peppermint (Mentha piperita) by Karuza et al. (1996). Ferreres et al. (1997) observed the acylated flavonol glycosides from spinach leaves (Spinacia oleracea). Ten highly oxygenated flavonoids, including four new compounds were isolated from the leaves of Dancy tengerine (Chen and Mantanari, 1998).

The analysis of secreted flavonoids of the leaf Cistus landanifer was carried out by high performance liquid chromatography particle beam mass spectrometry (Olios- Jose et al., 1998).

A high performance thin layer liquid chromatographic method with densitometric detection has been used to determine the flavonoid contents from the leaves of Vaccinium myrtillus and V. Vitis idaea by Smolarz- Helena et al. (2000). Gins et al. (2000) isolated flavonoids and hydroxyanthroquinones from the stem of garland chrysanthemum (Chrysanthemum coronarium Linn.).

Flavonoids from the leaves of Melaleuca quinquervia were isolated by El-Toumy et al. (2001). Malas and Saric (2001) observed the flavonoids and phenolic acids from Helleborus atrorubens Waldst et. Kit.

Identification and isolation of flavonoid contents from the leaves and flowers of Acacia nilotica, Acacia senegal, Maytenus emarginata, Parkinsonia aculeata and Prosopis cineraria by Shahid (2002).

Kapoor and Ranga (2003) reported flavonoids from some Asteraceous medicinal plants of Rajasthan desert.

Bahadauria and Kumar (2004) reported free and bound flavonoids in
Lawsonia alba, Solanum dulcamara and Allium sativum.


Yadav et al. (2004) reported furano flavonoids from Pongamia pinnata fruits. Khatri (2005) reported the flavonoid contents (Quercetin and Kaempferol) in leaves and fruits of some medicinal plants like Abutilon indicum and Solanum nigrum and also observed antimicrobial activities against some fungal and bacterial pathogens.

Kapoor and Kumar (2005) reported that herbal plants of Rajasthan desert are a potential source of antimicrobial principles.

Rao (2007) has observed the antimicrobial principles (flavonoids) from some arid zone plants.

Singh (2008) has studied the antimicrobial principles (flavonoids) of plant species growing in Jhunjhunu district.

Soni (2008) has evaluated the antimicrobial principles (flavonoids) of some arid tree species growing in Bikaner district.

Amal et al. (2009) isolated different types of flavonoids from Leptadenia pyrotechnica and also evaluated their toxicity and antitumor activities.

Acharya (2009) studied flavonoid contents from some arid zone Tiliaceous plants of Rajasthan.

Swami (2009) evaluated flavonoid contents from some medicinal plants
of Sri Ganganagar district of Rajasthan.

In medicinal plants flavonoids was reported by many workers like Sagwan et al. (2010); Elhassan et al. (2010); Gupta et al. (2010); Dhale et al. (2010); Kalaiarasan et al. (2010); Ahmed et al. (2011); Sughuna et al. (2011); Sarma et al. (2011); Omogbai et al. (2011); Samejo et al. (2011); Valarmathi et al. (2012); Shareef et al. (2012); Suresh et al. (2012); Jogi et al. (2012); Sridhar et al. (2012); Patter et al. (2012); Agilandeswari (2012); Parveen et al. (2012); Mallam et al. (2012); Madhavan et al. (2013); Indhumol et al. (2013); Marzouk et al. (2013); Parmer et al. (2013); Sharma et al. (2013); Wake et al. (2013).

Kapoor and Mishra (2013) reported flavonoid contents from some Capparidaceous medicinal plants of North-west Rajasthan.

Kapoor and Pandita (2013) reported flavonoid contents from some exotic tree species growing in Rajasthan desert.

Kapoor and Bansal (2013) studied flavonoid contents from some medicinal tree species of Nagaur district of Rajasthan.

Kapoor et al. (2013) reported flavonoid contents from some medicinal plants species of Jhunjhunu district of Rajasthan.

Kapoor and Purohit (2013) evaluated flavonoid contents from some Fabaceous plant species of Rajasthan desert.

Kapoor and Lakhera (2013) studied flavonoid contents from some medicinal plant species of the Jodhpur district of Rajasthan.

Kapoor et al. (2013) evaluated flavonoid contents from some medicinal
plants of Jaisalmer district of Rajasthan.

Kapoor et al. (2014) reported flavonoid contents from some medicinal tree species of Sikar district of Rajasthan.

Kapoor and Kumar (2014) recently studied flavonoid contents from some medicinal tree species of Sirohi district of Rajasthan.

The present investigation has been undertaken to look into the scope of medicinal plants growing in semi-arid zone of Rajasthan to be used in drug and pharmaceutical industries.

An analysis of the medicinal flora of Barmer district shows diverse phytogeographical pattern. Due to extreme climatic conditions, plants of this area adapt themselves morphologically and physiologically. They not only provide food, wood, fiber and fuel to the human beings but are also good source of medicinally important compounds. So, the present study was made to find out the ethnomedicinal and phytochemical aspects especially secondary metabolites. The demand of drug yielding plants is increasing day by day.