Chapter - 1

INTRODUCTION

Insect initiated plant galls are always injurious to plant. Different species of insects form galls on various species of plants. *Pauropsylla depressa* forms galls on *Ficus glomerata*. *Ficus* is a genus of about 850 species of woody trees, shrubs, vines, epiphytes and hemi–epiphytes in Moraceae family. Synonym of *Ficus glomerata* Roxb. is *Ficus racemosa* Linn. and its english name is Fig and common name is *Udumbara, Umber, Gular and Doomar*. It is collectively known as Fig tree or Figs; they are native throughout the tropics with a few species extending into warm temperate zone (Plate - 1). *Fig* is a temperate species from the middle east and eastern (mostly Ukraine) which has been widely cultivated from ancient times for its fruits and constitute extremely important food resources for wild life (Plate - 2). Figs are also of paramount cultural important through out the tropics, both as objects to worship and for their many practical uses. Figs occupy a wide variety of ecological niches. Take for example, the common fig, a small temperate deciduous tree who’s fingered fig leaf is well known in art and iconography or the weeping fig (*F. benjamina*) a hemi – epiphyte with thin, tough leaves on pendulous stalks adapted to rainforest habitat or the rough leaved sand paper figs from Australia; or the creeping Fig (*F. pumila*). *Ficus glomerata* Roxb. is a medium tall tree having height upto 16 meters; bark elliptic covered with white dots; and
contains 14% tannin. Petiole half an inch long and more; *Ficus racemosa* resemble the figs (also known as Foolish’s Fig) green when raw, orange, dull reddish on dark crimson or ripening; seeds innumerable, tiny and grain like. Fruit mature generally from March to July; when fully ripe they have pleasant odour, resembling that of cider apples. Often they are unfit for eating. They may be dehydrated, ground into flour and taken with milk, sugar or used for preparing cold jelly. The powder from the roasted fruit form a valuable breakfast food, almost similar to imported Grape nuts (Parker, 1993). Analysis of the fruit gave the following values, moisture, 13.6; albuminoids, 7.4; Fat, 5.6; Carbohydrate 49.9; colouring matter, 8.5; Fibre, 17.9; ash, 6.5; silica (SiO$_2$), 0.25; and phosphorous (P$_2$O$_5$), 0.91%.

The latex of the tree contains 4.0 – 7.4% caoutchouc. The cooylum of the latex may be used in manufacture of waterproof bounded ground sheets. *Ficus glomerata* the host plant is of great economic value, as medicine, Gular plant (*Ficus glomerata*) hold a reputed position in all system of medicine in India. According to Ayurveda, roots are useful in hydrophobia where as bark is acrid, cooling, galactogogue and food for gynaecological disorders. Fruits are useful in treatment to leucorrhoea, blood disorders, burning sensation, fatigue, urinary discharges, leprosy, menorrhagia, epistaxis and intestinal worms. According to Unani system of medicine the leaves ground to powder and mixed with honey are given in bilious affections. Leaves (Plate – 2 B) are astringed to bowels and good in case of bronchitis, where as fruits are useful in treatment to dry cough, loss of voice, disease of kidney and spleen. Bark is useful in Asthma and piles. Fruits
(Plates – 2A,C) are astringent, stomatic and carminatic. The milky juice is administered in piles and diarrhoea (Kritikar and Basu, 1919). If roots of *Ficus glomerata* cut from the main plant, inside the soil, it exulates water. This water is collected carefully and used in different way. At specific doses it is given to diabetic patient early morning (empty stomach). It is suitable for match boxes (Pearson and brown, 1932). Thus, this plant is of great economic value for manking. This plant is found heavily infested by a gall forming insect, *Pauropsylla depressa* Crawford (Homoptera - Psyllidae) (Fig - 5 and Plate - 4). Mathur, (1935) and Beeson, (1941) have given its biology and gall forming habits. In heavy infestations, the leaves turns entirely *glomerated* with numerous galls (Fig - 10) and (Plate – 17C) (Raman, 1932) has described its nymphal stages. The description of the gall and distribution of the species are given by (Mani, 1954). In Saharanpur district of Western U.P, the Gular tree occurs in all the blocks (Fig. - 11) and suffer heavy infestation of *P. depressa* gall. Most of the psyllids form galls on different parts of host plants. Galls are abnormal growth not only foreign organism, but also mechanical irritation, wounds and certain chemicals like mulagenic agents, various amino acids and excessive indol acetic and other plant growth hormones commonly induce the formation of gall. “A gall is essentially a neoplastic growth, are pathological structures, ranging from the nearly normal to the highly complex and abnormal growth”. Thus, the galls are pathologically developed cells, tissue and organs of plants which have risen mostly by hypertrophy (over - growth) and hyperplasia (excessive cell division) usually under the influence of parasitic
organism (Figs – 2, 3 and Plate - 3). These represent the growth reaction of the plant to the attack by a foreign organism and are often related in some way to the feeding activity and nutritional physiology of this organism. The gall is, thus, a product of the interspecific association between a plant and another organism. Galls are epiphyllous, simple, globular, sessile, per foliate, unilocular, usually also in large fleshy, multilocular agglomerate masses with individual simple galls which have become fused into a composite mass, yellowish, orange, reddish or reddish – brown, almost entirely devoid of chlorophyll and always conspicuous against the back ground of the dark green foliage. As a principle “a gall provides nutrition and shelter to the inducing insect”. The physiology of gall formation is still obscure ant it is generally believed that a secretion from nymph stimulates gall formation. The galls are really the invaginated and swollen blade. Size 5 – 10 m.m in diameter. These are abnormal growth that occur on leaves, twigs, roots or flowers of many plants. Gall is a cumulative expression of a suite of adaptations achieved by the host plant for accommodating the inducing insect (Mathur, 1975).

Some galls are the result of infections by bacteria, fungi or nematodes are difficult to tell a part from insect caused galls. Galls are pathologically develop outgrowth (Mani, 1973). Most galls are caused by irritation or stimulation of plant cells due to feeding or eggs laying by insect such as aphids, midges, wasps or mites. Generally, galls are thick walled and almost solid; dehiscent when old and mature by lacerated openings on the under side; thus, letting out the full grown nymph of the psyllid
just before emergence of the adult. Ostiole hypophyllous and obliterated. The epidermis encloses a broad annular strip of undifferentiated parenchyma that surrounds the central gall cavity. Concentric layers of broken and irregular proliferating cells occur in the annular parenchyma. Numerous veins are scattered superficially or deeply in the parenchyma. There is no trace of the palisade or spongy tissue. In some young galls, a small fistular opening is found on the underside, while in the older galls this passage closes more or less completely due to cell proliferation. Galls are abnormal structures on the plant leaves which provide hinderances in the photosynthetic activities of the plant. Hence, galls are always injurious to plant and its growth is adversely affected or stunted. One or two galls on a leaf do not interfere much in the photosynthesis but when entire leaf turns gallinaceous and badly distorted this activity is greatly affected. Leaves are factories for photosynthesis which synthesize carbohydrate for plant growth as well as respiratory activities and transpiration etc. On become gallinaceous the leaves become unfit for these activities. Many changes, histologically and biochemically are induced in the leaves due to gall formation. Hence, to know all these changes present investigations on “Histomorphology, ecology and biochemistry of leaf galls of Ficus glomerata Roxb. induced by Pauropsylla depressa Crawford” have been taken up