A seed has been defined as a “matured ovule” but a slightly elaborate definition of seed—“a reproductive unit formed from a fertilized ovule consisting of an embryo, food store and protective coat”. These essential constituents of seed are common to all seeds (Khullar, et al., 1991).

Seeds of woody plants exhibit a great range of variation in shape, size, colour and seed coat surface. These are very often adapted to the conditions in which the various species evolved. Knowledge of seed morphology is advantageous for artificial regeneration as it can influence the collection, processing, storage and treatment of seeds. The external and internal morphological features of seed are remarkably stable (Martin and Barkly; 1981; Gunn, 1972; Kozlowski, 1972). The prominent features include shape and size, position of hilum, micropyle and lens.

Observation on the interval of time between flowering and seed ripening indicate great variation from species to species. Further in some species fruit fall on the ground as soon as they ripen, while in others like *Thespesia populnea* fruits are retained on the tree, sometimes even up to the next flowering season. In most species, where fruit ripening period extents upto a few months, ripening takes place in three phases; one initial phase, where 10% of the fruit ripen followed by a peak period, where the majority or about 80% of the fruits ripen. This is followed by the last phase or tail end, when rest of the fruits ripens (Ghyare, 2002).
The seeds which are used as medicine are wild harvested in forest and are 100% organic. This means that they are free of contaminants, such as synthetic fertilizer, herbicides and preservatives. The seeds are collected in such a way that there is no danger of damaged to the seeds, trees or to the environments. The wild harvested seeds are immediately stored in proper manner until their use (www.tropilab.com/seedlist.html).

1. *Azadirachta indica* A. Juss. (Plate 4.1)

Local name: Neem, Kadulimb

Family: Meliaceae

The Latinized name of neem *Azadirachta indica* is derived from the Persian name “Azad- Darakth-E-Hind”, which means free tree of India (Girish and Bhat, 2008). It is large deciduous tree reaching 20 m height, and observed all over India. The trees are adapted to a wide range of climates. It thrives well in hot weather. Presently the neem trees are established in at least 30 countries world-wide in Asia, Africa and, Central and South America (Lele, 2010).

Leaves unipinnate, 20-30 cm long, crowded near the ends of branches, leaflets sub-opposite, lanceolate, serrate margin, glabrous, petioles very short, flowers mildly fragrant, in axillary panicles, shorter than the leaves. Flowers off white in colour. Its flowering period is from January to May and fruiting period is from April to August. The fruits ripen from the month of May.

Fruits drupes, ellipsoid, 1-2 cm long, green in colour becoming yellow at maturity, 1-seeded. The seeds 15-20 mm long, 5-8 mm in width, oval in
shape, asymmetrical, slightly rough, seed coat cream colored with fracture lines, hilum apical, weight of 100 seeds 20.024 g.

More than 135 compounds have been isolated from different parts of neem (Girish and Bhat, 2008). All the parts of the plant contain limonoid bitter principles. The stem bark yields nimbin, nimbidin, β-sitosterol, tannins (12 %) and a gum. The root bark also contains nimbin and nimbidin. The leaves contain nimbin, rimbine, nimbandiol and β-sitosterol; and the flowers contain β-sitosterol (along with its glucoside) and Azadirachtene (Daniel, 2005). The most useful and valuable product of the tree are the seeds which yield 40 % of a deep yellow oil, the well known “margosa oil” (Girish and Bhat, 2008). The fruits are found to contain gedunin, azadirachtin, 7-deacetoxy-7α-hydroxy gedunin, azadiradione, azadiradone, 17-β-hydroxy azadiradione, 17-epi azadiradione and nimbiol. Neem seeds yield oil and the number of bitter principles both in oil and outside. The oil consists of oleic, palmitic, stearic and linoleic acids and 0.8 % unsaponifiable matter containing nimbidine, nimbin, niminene, meliantriol etc. (Daniel, 2005).

The uses and medicinal properties of the plant have been categorized variously by Dastur (1962), Bentley and Henry (1981), Parikh (1999) and Nadkarni (1982).

Neem is used in Ayurvedic medicine for the treatment of various diseases like leprosy, skin diseases, fever; for purification of blood etc. Leaves are applied as polutice to boils. Decoction of leaves is antiseptic and is used in ulcers and eczema. Bark, root bark and young fruit are bitter tonic, alterative,
astringent, anthelmintic and antiperiodic (Joshi, 2000). Gudunin isolated from neem seed oil has been reported to possess both antifungal (Rao et al., 1977) and antimalarial properties (Khalid et al., 1989).

Gum is demulcent, tonic, in catarrh affections. Dry flowers are tonic and stomachic. Oil is stimulant, antiseptic, alterative; useful in rheumatism and skin diseases. Bark, gum, leaves and seeds are used in snake bite and scorpion sting. Flowers and berries are purgative, emolient and anthelmintic. Alcoholic extract of bark is anticancer, antiviral and spasmogenic (Joshi, 2000).

*A. indica* is a homeopathic remedy. It is a grand remedy in chronic fever. It is useful in cases previously maltreated with quinine (Joshi, 2000).

2. **Butea monosperma.** (Lam.) Taub. (Plate 4.2)

Local Name : Palas

Family : Fabaceae

The plants are found all over India. It is a dominant species in the forests. The tree is called as a “Flame of the forest’. A small to medium sized deciduous tree with a crooked trunk and branches. It grows up to a height of 4-6 m, bark ash colored and cracked. All parts tomentose, leaves trifoliate, with 8-12 cm long petioles. All the leaflets are leathery and stiff, obtuse or rounded at the apex. Young leaflets are finely silky, older ones are smooth but hairless. The leaves fall off in winter and the flowers appear on the tree at the beginning of summer, when the tree is completely leafless. The flowers are large and in dense rigid racemes. They are densely crowded on the leafless branches, which
are salmon or orange colored and clothed outside with silvery hairs. The fruit is a flat pod or legume, 12-18 cm long and narrowing somewhat towards the tip, pods are one seeded, reticulate veined and silvery tomentose.

Seeds 24-38 x 19-27 x 5-6 mm; not angular; asymmetrical; irregularly reniform, hilum lateral. Seeds are flattened with surface wrinkled; colour reddish brown; glabrous, not smooth (Kirkbride et al., 2003). Weight of 100 seeds 100 g.

The seeds mainly contain α-amyrin, β-sitosterol, its glucoside and sucrose; glycerides of palmitic, stearic, linoceric, oleic and linoleic acids from seed oil. A nitrogenous acidic compound along with palasonin, butrin, isobutrin, coreopsin, isocorepsin and sulfurein are also present. Flowers contain butrin, butein and butin. The seeds, gum, flowers, bark and leaves are used in medicine.

Seeds are acrid, bitter, aperients, sedative, rubefacient; used as a vermifuge and in snake bite. Decoction of seeds is given in gravel. Paste of powder with lemon is applied as a cure for ring-worm and herpes for its cooling effect. Seeds are antihelmintic but not safe as they may cause nephrotoxicity. Extracts of seeds, flowers and leaves are reputed to have contraceptive properties (Joshi, 2000).

Different parts of the plant have also been reported for their medicinal value. The gum is a powerful astringent, used for diarrhoea, and haemorrhage from stomach and bladder. Bark is antihelmintic and used for tumors, bleeding piles and ulcers. Roots are used in elephantiasis, night blindness and other
problems of vision. Leaves are also tonic, diuretic and used to cure boils and pimples. Flowers also possess similar properties and used for leprosy and gout (Daniel, 2005).

The wood of *Butea* is dirty white in colour and is not durable, so it is not used commercially. The branches cut by local people are used as fuel. It is good fuel and gives a good charcoal. The leaves, flowers and bark are used for plate making and fodder, for dye and for making ‘coarse fiber’ respectively. A gum is also extracted from stem (Korekar, 1999).

3. *Holarrhena pubescens* (Buch-Ham) Wall. ex DC. (Plate 4.3)

Local Name : Kudaa, Indrajav

Family : Apocynaceae

Large shrubs or small trees, 5-10 m tall. Plants occur occasionally on hill slope in forests. Bark is pale brown in colour. Young part pubescent. Leaves are shiny on upper surface, dull and hairy on lower surface; and are broadly elliptic-ovate, 5-16 x 4-10 cm, sub-sessile, obtuse at base, entire. Flowers and fruits appear form April to July. Flowers in terminal position. Inflorescence is corymbose cyme. Corolla white coloured. The fruits are cylindrical, dark grey with white specks, and occur in pairs.

Seeds are light brown, 5-15 mm long. Seeds linear-oblong, tipped with deciduous coma of brown hairs, 2-2.5 cm long, surface rough, hilum lateral, asymmetrical, weight of 100 seeds 2.274 g.
Seeds contain a drying oil and an alkaloid antidysentericine. Latex contains caoutchouc and two resinols. It is useful in the synthesis of steroid hormones. Bark contains a large number of alkaloids (Joshi, 2000).

The bark of the stem and root, preferably of the young plants, and the seeds, are well known as remedies in acute and chronic diarrhoea, and in dysentery. The bark contains an alkaloidal principle which has been named conesscine and kurchiene which has been employed medicinally. The bark has astringent, antidysenteric, febrifuge and antihelmintic properties. It is used in the form of powder; other preparations are the solid and liquid extracts and the decoction (Nadkarni, 2004).

4. **Madhuca longifolia** (Koen.)Macbr. (Plate 4.4)

Local name : Moha, Mahua

Family : Sapotaceae

Plants large, deciduous, heights 15-30 m. bark thick, cracked, pale brown; sap milky. Leaves alternate or sub-opposite often clustered at the ends of branchlets. Flowers in dense fascicles near the end of branches, cream colored corolla 13-16 mm long, February to April is the flowering period. The young fruits are flashy green berries and quite large in size. Fruits ripen during June to August and fall by it self. Fruits 1- 4 seeded.

Seeds ovoid-ellipsoid, 36-40 x 18-20 mm in size, symmetrical, hilum apical, polished brown and weight of 100 seeds 195.0 g.
Seed kernels yield mahua oil. Fruit on steam distillation yield a volatile oil. Sucrose, \( \beta \)-sitosterol and a sterol glucoside are present in nuts. Lupeol acetate, \( \beta \)-amyrin acetate, betulinin and oleanolic acids can be obtained from bark (Joshi, 2000).

Medicinal uses of *M. longifolia* are described by various authors (Chopra, 1956; Dastur, 1962; Saxena, 1989) and also in wealth of India (1962). Bark is used for rheumatism, ulcers, itches, bleeding and spongy gums, tonsillitis and diabetes mellitus. A decoction of bark is used as astringent and emollient, also as a remedy for itch. Flowers are cooling, demulcent, laxative, tonic, stimulant, anthelmintic; used in coughs, colds, bronchitis, snake-bite and fish-poison. Seeds are galactagogue, laxative in habitual constipation and piles. Oil from seeds has emollient properties and is good for skin diseases. It is used in rheumatism and headache. It is laxative, useful in piles and hemorrhoids, also used as emetic. Honey obtained is used for eye diseases. Gummy juice is used in rheumatism. Fresh juice of Moha is alternative and the spirit distilled from the flowers is a powerful diffusible stimulant and an astringent. Mahua cake is insecticidal and pesticidal; used with shikakai for hair wash (Joshi, 2000).

5. *Plantago ovata* Forsk. (Plate 4.5)

Local name : Isabgol

Family : Plantaginaceae

*Plantago* is a large genus of herbs and sub-shrubs, distributed mostly in the temperate region and a few in the tropics. It comprises of about
200 species, of which 10-14 are natives of India. *P. ovata* Forsk. (Syn. *P. isphagula* Roxb.), commonly known as Isabgol, the name literally means ‘Horse-ear’, which is derived from Persian words, is important in commerce for its seeds and husk which have been used in indigenous medicine for many centuries. *Plantago* is from Latin, meaning ‘sole of the foot’ and refers to the shape of the leaf and *ovata* refers to the ovate shape of the leaves in Greek.

*Plantago ovata* (2n=8), belonging to the plantaginaceae family, is a stemless or short-stemmed, highly cross-pollinated, annual herb, which attains a height of 30 to 40 cm, has alternate leaves. The leaves clasp the stem, strap-like, recurved, up to 25 cm long, narrow-varying from less than 6.0 mm to 12.0 mm in width, tapering to a point, three-nerved, entire or toothed, coated with fine hairs. The flowers are white, minute, and four-parted. The capsule is ovate, 8.0 mm long, the top half lifting up when ripe; releasing the smooth, dull ovate seeds.

Seeds oval, smooth, 1.8 -3.8 mm long, pinkish-grey brown or pinkish-white with a brown streak on the convex surface, hilum lateral. The seeds are covered with a translucent membrane, known as the husk, which is odorless and tasteless. When soaked in water, the whole seed appears hugely swollen because of the expansion of the mucilage in the husk. The husked seeds are dark-red and hard (Farooqui and Sreeramu, 2004). Weight of 100 seeds 0.195 g.

The husk of the seed is the economic part and is separated by a physical process. The seed-husk contains colloidal mucilage (30 %), mainly consisting of xylose, arabinose, galacturonic acid with rhamnose and galactose, etc. The
seed also contains some oil and small amounts of glycoside acubin and tannin. The husk has the property of absorbing and retaining water and therefore, it works as an antidiarrhoeal drug. It is beneficial in chronic dysenteries of amoebic and bacillary origin. It is also used for treating constipation and intestinal disorders because it works as calorie-free fiber food, promoting regular bowel movement. It is reported to have no adverse side-effects.

The seed has also cooling and demulscent effects and is used in Ayurvedic, Unani and Allopathic systems of medicine. The seeds and husks are used to cure inflammations of the mucous membranes of gastro-intestinal and genito-urinary tracts, duodenal ulcers, gonorrhoea and piles. It can also be used as a cervical dilator for the termination of pregnancy.

In much affection of the kidneys and bladder, in gonorrhea etc, attended with pain, local irritation and scalding or difficulty in passing urine, the decoction of seeds is used.

In rheumatic and gouty affections, and the crushed seeds moistened with water form a good, soothing and emollient poultice (Nadkarni, 2004).

6. *Pongamia pinnata* (L.) Pierre (Plate 4.6)

Common name : Karanja

Family : Fabaceae

The trees of *P. pinnata* are medium sized, generally attains a height of about 8 m and a trunk diameter of more than 50 cm. It is deciduous and one of the few nitrogen fixing trees. The plants are distributed throughout the
Marathwada region. The trunk is generally short with thick branches spreading into a dense hemispherical crown of dark green leaves. The bark is thin grey to grayish brown. The alternate compound pinnate leaves consist of 5 or 7 leaflets, which are arranged in 2 or 3 pairs and a single terminal leaflet. Leaflets are 5-10 cm long, 4-6 cm wide and pointed at the tip (Lele, 2010). Flowers appear from October to December and fruits from February to June. Flowers in axillary racemes shorter than the leaves. Corolla is pinkish white in color, 10-12 mm long. Pods woody, oblong ellipsoid, 4-5 x 2-2.5 cm, compressed, recurved, mucronate (Naik, 1998).

Seeds ovate to reniform; 12-35 x 12-21 x 4-11 mm, solitary, brown in colour, compressed or flattened, surface smooth having fracture lines, with visible radicle and cotyledon lobes, hilum lateral. Cotyledons smooth; both outer faces convex; of the same thickness; more or less of equal length; folded or not folded (with short portions folded over the other cotyledon) (Kirkbride et al., 2003). Weight of 100 seeds 120 g.

The stem bark contains chromenoflavone, glabrin etc. The leaves yield karanjin, kanjone and other flavonoids. Dandekar and Gogle (2010) reported presence of phenols in the leaves. The flowers contain another furanoflavone pongaglabol and β-sitosterol. The fruits yield furanoflavonoids pongapinnol etc. (Daniel, 2005). The seeds contain 27 to 36.4 % of bitter fatty oil and traces of an essential oil. Seeds yield fixed oil and 3 crystalline substances karanjin, pongamol and glabrin. Roots contain four furoflavones, viz. keranjin, pongapin, pinnatin and gamatin. Seeds contain pongapin, flowers contain kaempferol and
waxes; stem-bark contain, waxes. Tetra-o-methylfisetin and pongachromene present in root and stem-bark and β-sitosterol in seeds (Joshi, 2000).

The seed oil is antiseptic and used in lucoderma. The seeds are used as expectorant and in whooping cough. A paste of the seed is used in leprous sores and painful rheumatic joints. It is also used as febrifuge and a tonic in asthmatic and debilating conditions (Daniel, 2005).

7. **Semecarpus anacardium** L.f. (Plate 4.7)

Local name : Bibaa, Bhilawa

Family : Anacardiaceae

These plants commonly occur on hill slopes and around fields. Distributed in all districts of Maharashtra. Small deciduous tree, 12-15 m tall; young parts grey pubescent. Leaves oblong to lanceolate, glabrous, simple 17.5-60.0 cm x 10.0-30.0 cm. flower sub-sessile, clustered in pubescent panicles, as long as or shorter than the leaves. Flowering June to November and fruiting period is from December to March. Color of flower is creamy-white. Male flowers minute, in the female subglobose, densely pilose (Naik, 1998).

Fruits drupes, shining black, obliquely ovoid, 2-2.5 cm long, seated on a fleshy, edible, orange colored thalamus. Seeds black, testa slightly rough, 25-32 x 20-22mm in size, asymmetrical, hilum apical, ovate. Weight of 100 seeds 230 g.

The nut contains a variety of phenols like bhilawanol, anacardic acid, cardol, catachol, anacardol, semecarpol and a fixed oil (Daniel, 2005).
Biba is eminent ayurvedic medicine. Its uses are many and varied. Fruit is acrid, hot, sweetish; aphrodisiac, anthelmintic; stays looseness of bowels; removes vaata, kapha and is considered beneficial in ascites, tumours and warts, acute rheumatism, asthma, neuralgia, piles, dysentery, fevers, loss of appetite, urinary discharges, epilepsy and psoriasis. It heals ulcers. Juice of pericarp and the oil are powerful counter irritant and vesicant. Oil is powerful antiseptic and cholagogue. Nut is a gastro-intestinal irritant when taken by mouth. Ripe fruits are stimulant, digestive and nervine. Nut bruised and given as vermifuge.

Gum from the nuts is used in venereal and leprous affections and nervous debility. Kernel is nutritive, appetizer, digestive and carminative. It is a good cardiac tonic and general respiratory stimulant. It is also used in homeopathic medicines (Joshi, 2000).

The seeds contain oil which is dark, viscous, highly vesicant liquid which contain “Bhilawanol” and other compounds (Kapoor, 2005). Williamson (2002) states that the seeds contain phenolic compounds and flavonoids. The phenolic compounds include derivatives of anacardic acid including “Bhilawanol”. Bhilawanol is a mixture of 1, 2-dihydroxy-3-(pentadecenyl-8’) Benzene and 1, 2-dihydroxy-3-(pentadecadienyl-8’-11’)-benzene (Williamson, 2002).

8. **Tectona grandis** L.f. (Plate 4.8)

Local name: Saagwaan, Teak

Family: Verbenaceae
Tectona and Teak are both derived from the Portuguese name teca, which is from the Greek tekton “a carpenter”. Grandis, in Latin means “large” (Cowen). It is a most important timber species found in this region. It is commonly growing in hilly tracts. A large deciduous tree about 10-20 m tall. Bark 18 mm thick, grey fibrous with shallow, longitudinal wrinkles. Leaves large, glabrous, rough, opposite, subsessile, elliptic or obovate, cuneate at base, margin entire with acute apex.

Flowers appear from June to August or September, according to season, but at some places they appear in April. Fruits ripen from November to January and fall gradually. The nut is enclosed in an inflated baldder like calyx, about 1.6 to 3 cm in diameter. Teak fruits are sown whole as seeds are very delicate and deeply embedded in woody locules. Fruit is a hard irregularly globose nut, somewhat pointed at the apex, enclosed in a thick, fatty, light brown covering; but varying much in size, containing 1 to 3 rarely 4, and occasionally six seeds. Fertility varies from seed source to seed source and seeds are also difficult to germinate due to presence of multiple dormancy.

Seeds light brown colored, 0.8 to 1.2 cm in diameter, globose to sub-globose, testa rough, furrowed, hilum lateral, asymmetrical. Weight of 100 seeds 15.352 g.

The wood contains in its cavities white crystalline deposits of calcium phosphate, silica, ammonium and magnesium phosphate, also a resin. Seed contains bland fatty oil. The oil contains caprylic, capric, lauric, myristic, palmatic, stearic, oleic and linoleic acid (Farooq, 2005).
Different parts of the tree are used for various medical treatments. Roots are given in retention of urine. Flowers are useful in bronchitis, urinary discharges etc. Wood pest is astringent, stimulant and sedative. Wood brayed in water is used to relieve headache, toothache etc. Ashes are applied to swollen eyelids. Oil of nuts is used in scabies itchiness and to promote growth of hairs (Joshi, 2000).

The seeds are astringent, emollient, diuretic and demulcent and are useful in vitiated conditions of Vata strangury, skin diseases and pruritus. The oil obtained from seeds, flower and wood is trichogenous and is useful in the treatment of eczema and ringworm (Warrier et al., 1997).

Teak is a relatively easy wood to saw and work. It can be finished to a fair surface and takes polish well. It is important furniture wood of the country. It peels off easily and makes up into excellent plywood. It is also used in railway benches, sleepers, ship building and house building (Mehta, 1981).

9. *Thespesia populnea* Soland ex. Correa. (Plate 4.9)

(Syn. *Hibiscus populnea* L.)

Local name : Paarosaa pimpal

Family : Malvaceae

*Thespesia* is derived from the word Thespesios meaning “divine” and the tree is named thus because it is frequently planted near churches and temples. *Populnea* means “having leaves like a poplar” (Cowen). Trees occasionally planted along roadsides. Flowering and fruiting period- September
to January. Evergreen medium sized tree, 5-6 m tall. Leaves broadly ovate, alternate, long petioled, glossy green, 5-15 x 4-16 cm. Flowers axillary, solitary 5-6 cm across. Corolla yellow with pink purple centre; petals ob lanceolate. Capsules pyriform, depressed at the top, 2-3 cm in diameter and contain about 12 to 16 seeds. Seeds are blown short distances by wind but are more likely to be dispersed by water (Parotta, 1994).

The brown, hairy seeds are about 1 cm long and 0.6 cm broad, ovate, surface rough with fracture lines, hilum apical, asymmetrical. Weight of 100 seeds 14.837 g.

Calycopterin present in heartwood. Flowers contain populneol, gossypol, kaempferol, quercetin, rutin etc. Thespisin present in the fruits. Seeds contain fatty oil rich in linoleic and oleic acids, ceryl alcohol and β-sitosterol (Daniel, 2005). All the parts of the plant are used in Indian system of medicine (Parthasarathy et al., 2009).

The plant is a reputed remedy for skin diseases. It is light, acrid, cooling and astringent. It is useful in dysentery, piles, diabetes, hemorrhoids. It cures ulcers, itching, scabies, other skin diseases and urinary disorders. Root is tonic. Bark is astringent given internally as an alterative, in the form of hot polutice. Leaves are beneficial in painful joints. Fruits, leaves and roots are applied externally to scabies, psoriasis and other skin diseases (Joshi, 2000).

Fruit abounds vescid yellow juice which is used as an external application to bruises, sprains insect bites, in psoriasis, scabies etc. The
contents of the fruit (which is a capsule) are applied to ringworm (Nadkarni, 1982).

The seed extracts of *T. populnea* revealed the presence of various phytochemical active compounds such as alkaloids, flavanoids, phytosterol, tannins, glycosides, and phenolic compounds. Laboratory studies showed that the seed extracts have hypoglycemic and antihyperglycemic effect in normal and diabetic rats (Belhekar *et al.*, 2009).