7. Summary and Conclusion
Asthma is a disease which claims lives of people every year. The WHO recognizes asthma as a disease of major health importance and plays a role in the co-ordination of international efforts against the disease. India has an estimated 40 million asthmatics. Economic burden of asthma is very widespread in reality. Worldwide, the economic cost associated with asthma is estimated to exceed those of T.B and HIV/AIDS combined. About 80% of world population relies on the use of traditional medicine for treatment of various diseases; which predominately based on plant materials. In the present scenario, the demand for plant products are growing exponentially throughout the world and major pharmaceutical companies are currently conducting extensive research on plant materials is the need of the day. Many of them do not have standard identification tests or analytical procedures to maintain their consistent quality. In the view of problems reported above, it was thought worthwhile to undertake work on anti asthmatic herbal drugs. The present study was taken up with the aim of assessing *Albizia lebbeck*, *Euphorbia hirta* and *Sphaeranthus indicus* for their anti asthmatic activity and developing their standardization profile.

Bark of *Albizia lebbeck*, aerial parts of *Euphorbia hirta* and *Sphaeranthus indicus* were collected from local campus of Vallabhbh Vidhyanagar in month of March, September and December respectively.

*Albizia lebbeck* showed typical morphological characters of bark outer surface is buff while inner surface is reddish brown. In T.S. it showed rhytidoma, phloem fibers with prisms, brownish content etc. Powder showed radially and tangentially elongated medullary rays, sclerids etc.

*Euphorbia hirta* can be easily identified with copious crisped hairs and lanceolate leaves with serrate margin. T. S. of root is typical root showed
narrow phloem with wider wood and traversed by uniseriate medullary rays, starch is present through the section. T.S. of stem showed typical dicot stem in which pericyclic fibers in group of 10 to 15 and pith showed presence of starch. T.S. of leaf is typical dicot leaf with 2 to 9 celled trichomes, anomocytic stomata and latex gland in mesophyll region. Powder showed presence of petals in surface view, starch, latex cells and 2 to 9 celled trichomes. Stomatal number of upper epidermis is lower 213 than lower surface 286. Stomatal index is also higher 17.04 for lower surface than upper surface 16.421. Vein islet no and vein termination number is 24.44 and 41.77 respectively. Palisade ratio is 7-8.

*Sphaeranthus indicus* herb is easily identified with sessile, decurrent obovate to oblong leaves. Pink colored heads are characteristic diagnostic feature to identify the plant. T.S. of root is typical dicot root with pericyclic fibers, stone cells and secretary canals and xylem and phloem are traversed by bi-to pentaseriate medullary rays. T.S. of stem showed papillose cutical and bicolateral vascular bundle. T.S. of leaf is typical dicot leaf structure with 3 to 4 collateral vascular bundle associated with group of scleranchymatous cells on either side. Powder showed presence of pollen grains in pollen sac, balloon shaped trichomes on the calyx.

The physicochemical parameters like Ash values (total ash, acid insoluble ash, water soluble ash), extractive values (alcohol soluble and water soluble extractive values) of *Albizia lebbeck* and *Sphaeranthus indicus* are within the limit given in Ayurvedic Pharmacopoeia. Above mentioned parameters of *E. hirta* are not given in literature and so these may be used for development of its monograph.
Heavy metal analysis indicated that the plant materials used were free from heavy metal contamination.

Chemical test and TLC analysis of successive solvent extract indicated that bark of *Albizzia lebbeck* was rich in flavonoids, saponins, carbohydrates, tannins, phenolics, phytosterols and triterpenoids content. While aerial parts of *Euphorbia hirta* showed presence of flavanoid, carbohydrates, tannins, coumarins, steroids and triterpenoids and aerial parts of *Sphaerantus indicus* indicated presence of alkaloids, carbohydrates, phenolics, volatile oils, phytosterols and triterpenoids content.

Significant amount of phytomarkers i.e. betulinic acid, quercitrin and β-Caryophyllene were successfully isolated from *Albizzia lebbeck*, *Euphorbia hirta* and *Sphaerantus indicus* respectively by preparative TLC. The identity of isolated phytomarker was confirmed with identical data of respective standard phytoconstituent obtained by sophisticated instrument and developed precise, rapid and accurate method of standardization of selected drugs.

HPTLC analysis showed amount of betulinic acid in bark of *A. lebbeck* was 0.02 %w/w while that of quercitrin in aerial parts of *E. hirta* was found to be 3.03 %w/w. while GC analysis showed presence of 1.27 % v/v of β-Caryophyllene in volatile oil of *S. indicus*. Validation parameters of developed method for each marker were within the limit.

A significant protection of mast cells from disruption caused by compound 48/80 was observed in animals treated with alcoholic extract of bark of *Albizzia lebbeck*, aerial parts of *Euphorbia hirta* and *Sphaerantus indicus* in our study.
Summary and conclusion

The leakage of dye was significantly less in the animals treated with alcoholic extract of bark of Albizia lebbeck, aerial parts of Euphorbia hirta and Sphaeranthus indicus. This can partly be due to inhibition of leukotriene synthesis. There was no effect of PEF on leakage of dye.

Alcoholic extract of developed formulation significantly increased the activity of SOD and catalase at 300mg/kg P. O. dose. It also significantly increased the levels of reduced glutathione and decreases the level of MDA. Histopathological alterations on lungs and bronchiole of animal treated with dexamethasone and developed herbal formulation (ADF) were also observed. Histological changes were found to be significantly improves similar to normal in treated group of animals when compared with control/normal group.

The results of these studies showed that the alcoholic extract of bark of Albizia lebbeck, aerial parts of Euphorbia hirta and Sphaeranthus indicus and developed formulation was found to be effective in various experimental models of asthma. Stabilization of mast cells, inhibitory effected on immediate hypersensitivity reactions, antieosinophilic activity and antioxidant activity appeared to be involved in its mode of action.

The results of the mechanisms of anti asthmatic effect have been discussed in the light of above observations. It has been concluded on the basis of all the studies that the plants Albizia lebbeck, Euphorbia hirta and Sphaeranthus indicus and their developed formulation offer a scope for studying them to exploit their use in clinical practice.