7. SUMMARY AND CONCLUSION

In India numbers of traditional systems of medicine are practiced since centuries. These include Ayurveda, Sidha, Unani etc. apart from those having ethnobotanical usage of herbs at regional level by the inhabitants or tribes, as medicine. Although these systems possess rich heritage as health care, these were confined to Vaidyas, Hakeems etc. and were not reached to industrial level of manufacture and distribution of different formulation practiced, due to lack of documentation of scientific facts regarding the properties of drugs and medicaments used.

Investigations on plant for their biological utility therefore have become important task throughout the world on a scientific basis.

The present study was envisaged to systematically validate two selected medicinal plants designated as anti-rheumatic in traditional medicine. Selected plants for study were Rivea hypocrateriformis and Ipomoea eriocarpa. Although the leaves of Rivea hypocrateriformis are reported to possess use in rheumatic pain and similarly the use of whole plant of Ipomoea eriocarpa in the indigenous systems of medicine is to cure headache, rheumatism, leprosy, ulcer, epilepsy and fever, but no systematic and detail studies for anti-rheumatic potential have been done yet. The present study was therefore, undertaken to evaluate and investigate more details in microscopical, phytochemical and pharmacological properties of these two plants.

Hence, the leaves of Rivea hypocrateriformis and aerial parts of Ipomoea eriocarpa were screened for anti-rheumatic activity. Rivea hypocrateriformis leaves were collected in the month of October from Kapadwanj, Dist. Kheda (Gujarat), India. The fresh aerial parts of Ipomoea eriocarpa were collected in the month of December within local campus of New Vallabh Vidyanagar, Dist. Anand, Gujarat. Both the plant materials were authenticated in the Department of Biosciences, Sardar Patel University, Vallabh Vidyanagar, Gujarat.
The selected plant materials were first evaluated for their correct identity by studying their pharmacognostic features. Various quality control parameters like foreign matter, ash values, extractive values, loss on drying, elemental analysis were determined as per WHO guidelines. The coarsely powdered plant material were than successively extracted with solvents of increasing polarity viz., petroleum ether, toluene, chloroform, methanol and water. The successive extracts were then subjected to preliminary phytochemical test for the presence of secondary metabolites. A complete thin layer chromatography profile of the secondary metabolites comprising of the $R_f$ values and the percentage proportion of the individual components in the extract were recorded and documented. Isolated compounds from both the plants were analysed and quantified by spectroscopies studies & HPTLC methods.

In order to derive scientific evidences to the reported traditional claims, *in vitro* analgesic, anti-inflammatory and anti-arthritic activity was performed for methanolic extracts.

**Rivea hypocrateriformis**

Some important morphological features for the identification of *Rivea hypocrateriformis* leaves were observed and documented herein. *Rivea hypocrateriformis* is a woody climber with simple leaves which are arranged in alternate manner. Leaves were green, ovate-orbicular, appressedly silky hair beneath, petiolate and with characteristic odour & taste.

Microscopical evaluation remains indispensable and cost effective tool of conventional analytical Pharmacognosy. So, important microscopic features of leaf of *Rivea hypocrateriformis* have been documented in the present study.

Microscopic features of leaves & petiole showed that leaves were bicollateral in nature. The laminas consisted of upper epidermis followed by palisade cells that were elongated on the vertical axis with no air spaces. Mesophyll region
distinctly differentiated into palisade and spongy cells. Cells of palisade parenchyma were very compactly arranged in two layers.

In the mesophyll the vascular bundles were intermediately consisted of reticulate lignified xylem and non-lignified phloem. Numerous rosette type of calcium oxalate crystals were presented in spongy tissue on the lower side of the lamina.

The midrib was more curved than the upper side. The first layer upper epidermis was continuous with that of the lamina and similar in character, followed by a layer of collenchyma cells. The next layer was the phloem consisting of phloem fibers and parenchyma cells. The xylem elements consisted of xylem vessels, xylem fibers and medullary rays crossing in between.

The transverse section of the leaf petiole was circular in outline with trichomes emerging all over the surface consists of epidermis, cortex and stellar region with prominent pith. In the proximal part three vascular bundles were present, of which median bundle was larger and other two lateral vascular bundles were smaller, conjoint, collateral and endarch. Presence of rosettes shape calcium oxalate crystals scattered in pith.

Powder microscopy analysis of leaves showed the presence of rosette types of calcium oxalate, fragments of mesophyll, paracytic stomata, unicellular trichomes and fibres.

Proximate analysis was performed to help setting certain standards for dried drugs in order to avoid batch-to-batch variation and to judge their quality and purity. Parameters like total ash, acid insoluble ash, water soluble ash, water soluble extractive value and alcohol soluble extractive values, elemental analysis and fluorscence anlaysis were studied under proximate analysis.
The water soluble extractive values (10.47 %) of *Rivea hypocrateriformis* leaves were high as compared to alcohol soluble extractive value (7.92 %) indicated that high quantities of polar constituents were present in them. These determinations provided an idea regarding the probable content of various inorganic metal ions as well as the nature of the constituents present. More ash value (7.57 %) indicates the presence of more inorganic matter.

Results of elemental analysis showed that potassium (1.37 %) and calcium (1.53 %) were present in highest quantities leaves. Apart from this iron, magnesium, phosphorus was present in smaller quantities in leaves. The contents of elements were found to be within limit.

The colour of the plant extract in UV light is mainly due to its chemical composition. The same extract may appear in different colours at different wavelength of light (254 and 366 nm) and these colors are characteristic for the particular drug or different parts of same drug. Therefore, fluorescence studies were done on powdered leaves of *Rivea hypocrateriformis*.

Successive extracts were prepared by subjecting coarsely powdered plant materials to the solvents of increasing polarity viz., petroleum ether, toluene, chloroform, methanol and water. The successive extracts were subjected to various qualitative chemical tests to determine the presence of various phytoconstituents.

Qualitative tests for different extracts of *Rivea hypocrateriformis* showed maximum constituents were positive for methanolic extracts such as carbohydrates, saponins, alkaloids, coumarins and phenolic compounds. Phytosterol, alkaloids and carbohydrates were present only in some extracts. Results of preliminary phytochemical tests indicated that coumarins and phytosterols were the major group of constituents present in most of the extracts of leaves.
Thus, in continuation of our studies on qualitative analysis of secondary metabolites present in successive extracts of leaves of *Rivea hypocrateriformis*, thin layer chromatography (TLC) studies was performed. A complete TLC profile of the successive extracts comprises of R_<sub>f</sub> values for chemical constituents present in the extracts were recorded and documented.

Four compounds RHI-1, RHI-2, RHI-3 and RHI-4 were isolated by preparative TLC of the defatted methanolic extract of leaves of *Rivea hypocrateriformis*, these isolated compounds were then subjected to determination of various physical characteristic like melting point, FT-IR, 1 H NMR and Mass spectra of individual’s compounds were performed to elucidate the chemical structure. Compound RHI-1 was to be identified as 4-hydroxy 2H-chromene-2-one (4-hydroxy coumarin) (C<sub>9</sub>H<sub>6</sub>O<sub>3</sub>) M.P 210-212<sup>0</sup>C. Its chemical structure was unambiguously elucidated by analysis of FT-IR, H NMR and Mass data.

**FT-IR:** 3524, 3405(-OH), 2956, 2925(CH<sub>2</sub>), 1733(C=O), 1623(C=C), 1384(aromatic C=O), 1115 cm<sup>-1</sup> (Aromatic C-H in-plane bend), cm<sup>-1</sup>; **1 H NMR:** δ 1.25- 1.80(C-H with no attached functional group) 2.9-3.25 (oxygenated H), 3.50-4.90 (alcoholic H), 7.60-8.40(Ar-H) ; **Mass:** m/z (%): 146.03, 118.04, 89.038 cm<sup>-1</sup>.

Compound RHI-2 was to be identified as 6-O-demethylsalutaridine (C<sub>18</sub>H<sub>19</sub>NO<sub>4</sub>) M.P.197-199<sup>0</sup>C.

**FT-IR:** 3366, 2923, 2852 (Aromatic C-H stretch), 1641, 1546, 1462 (Aromatic ring stretch), 1253, 1233 (Aromatic in plane bend), 1137, 1102, 1064 (Tertiary amine C-N stretch) cm<sup>-1</sup>. **1 H NMR:** δ 1.2, 2.9 (C-H), 3.3, 3.5 (Oxygenated CH), 4.8 (Alkenes H), 7.5 and 8.5 (Ar-H) . **Mass:** m/z (%): 313.13 (M+), 285, 268, 256, 241, 212, 184 and 168.

Compound RHI-3 was to be identified as 3-(benzimidazol-2-yl)-7-(diethyl amino) chromen-2-one (C<sub>20</sub>H<sub>19</sub>N<sub>3</sub>O<sub>2</sub>) (Figure 5.17) M.P.201-203<sup>0</sup>C.
FT-IR: 3233 (Amino group broad), 2921, 2852, 2344, 1642 (Conjugated ketone), 1507 (Ar-nitro compound), 1229, 1144 (t-amine, aromatic) and 777 (CH bending) cm$^{-1}$. 1 H NMR: $\delta$ 1.2 (CH with no functional group), 2.9, 3.3, 3.5 (Oxygenated H), 4.8 (Alkenes H), 7.5 and 8.5 (Ar-H) Mass: m/z (%): 333.14 (M+), 318.12, 289.08, 261 and 205.

Molecular formula for compound RHI-4 was found to be as bergenin [3, 4, 8, 10-tetrahydroxy methyl-9-methoxy-3, 4, 4a, 10b-tetrahydro-2H-pyranol (3, 2-C) isochromen-6-one] ($C_{14}H_{16}O_{9}$) M.P.148-149$^\circ$. The structure elucidation of compound RHI-4 was performed with the help of overlaid IR, NMR, Mass spectroscopy and co-TLC analysis.

Co-TLC confirmed RHI-4 to be as bergenin, in comparison with an authentic standard bergenin. (ethyl acetate: formaldehyde: acetic acid: water; 10:1:1:2; derivatization was carried out with alcoholic KOH), $R_f=0.49$.

RHI-4: FT-IR: 3422.13, 3390.64, 3249.42 (broad –OH), 2955.04, 2893.63 (CH$_2$), 1703.31 (\(\alpha,\beta\) unsaturated $\delta$ lactone), 1612.05, 1268 (aromatic C-O), 819 (C-H) cm$^{-1}$ 1 H NMR: $\delta$, 3.98 (3H, s, Ar-CH$_3$); 4.50-5.81 (Complex m, methylenes and hydroxyls); 7.52 (1H, s, Isolated Ar-H) $\delta$ 1.2, 2.9, 3.3, 3.5, 4.8, 7.5 and 8.5 Mass: m/z (%): 326 (M+), 208, 180, 100 and 66

And all these comparisons for isolated compound RHI-4 which was identified as bergenin 3, 4, 8, 10-tetrahydroxy methyl-9-methoxy-3, 4, 4a, 10b-tetrahydro-2H-pyranol (3, 2-C) isochromen-6-one]

Bergenin in the leaves of *Rivea hypocrateriformis* was estimated by HPTLC technique and amount of bergenin found was 1.256 ng/spot. The correlation coefficient for bergenin was found to be 0.997 and relative standard deviation ranged from 0.09-0.32 which suggested test results was directly proportional to the concentration of an analyte in standard calibration curve for analyte. The % recovery of bergenin was found to be 99.62-100.36% which suggesting the closeness of the test results obtained by the method to the true value and
exactness of the analytical method developed. The minimal detectable limit found was 4.8 ng/ml and limit of quantitation was 14.56 ng/ml which suggested that the other constituents present in the crude drugs did not interfere with the peak of bergenin and thus the method was selective and specific.

Acute toxicity was studied on methanolic extract of *Rivea hypocrateriformis* leaves (MRH) orally by ACUTE TOXIC CLASS METHOD (OECD GUIDELINES 423) with a starting dose of 2000mg/kg body weight for all the extracts which showed no mortality when it was observed for 72 hours. And at the end of 3 days, as it showed no mortality the same dose was repeated for the same set of experiment and again it showed no mortality. So, the LD50 cut off was grouped under category X and it was classified under group X (unclassified group) according to GHS system for classification of toxic chemicals. Thus, acute toxicity revealed the non-toxic nature of the methanolic extract of *Rivea hypocrateriformis* leaves (MRH). There was no lethality or any toxic reactions found at any of the doses selected until the end of the study period.

In **hot plate method** MRH extract significantly increased the reaction time of the animals towards the thermal source in a dose dependent manner. MRH 250 mg/kg; P.O. & 500 mg/kg; p.o.. showed a pain inhibition of 133.67 % (p <0.01) & 174.14 % (p< 0.01) respectively, standard drug pentazocine (10 mg/kg; Sc.) produced 262.93 % (p< 0.001) inhibition when compared with control group.

In **carrageenan induced paw edema** is a biphasic response. The first phase is mediated through the release of histamine, serotonin and kinins whereas the second phase is related to the release of prostaglandin and slow reacting substances. The MRH extract produced dose dependent and significant inhibition of carrageenan-induced paw edema. MRH 250 mg/kg; p.o. & 500 mg/kg; p.o. showed a significant inhibition in paw volume (63.21%) &
(76.32%) respectively, standard drug diclofenac sodium (15 mg/kg; p.o.) produced 82.89 % inhibition when compared with control group.

In **Freund’s adjuvant induced arthritis** body weights were found to be significantly decreased in control rats (18.87 %) on day 21st. Treatment with MRH 250 mg/kg; p.o. (12.34 %) & 500 mg/kg; p.o. (11.08 %) showed significant change in body weight as compared to control rats on day 21st that was comparable to standard drug diclofenac sodium (20 mg/kg; p.o.) (10.08 %)

The increased biochemical parameters SGOT, SGPT and ALP level in serum were significantly prevented with the concomitant treatment of MRH extract at dose level of 250 mg/kg; P.O. & 500 mg/kg; p.o. and diclofenac sodium (20 mg/kg; p.o.).

The erythrocyte sedimentation rate (ESR) level which was markedly elevated in arthritic control group (13.16 mm/hr) of rats was decrease significantly with MRH 250 mg/kg; p.o. (12.16 mm/hr) and 500 mg/kg; p.o. (11.5 mm/hr) dose and the effect was comparable to standard drug diclofenac sodium (20 mg/kg; p.o.) (10.5 mm/hr)

Treatment with MRH orally at 250 mg/kg & 500 mg/kg dose level showed significant lower value of arthritic index 2.73 & 2.37 as compared to control animals (4.78).

In **Freund’s adjuvant induced paw edema** the MRH extract produced dose dependent and significant inhibition of paw edema volume. MRH 250 mg/kg; p.o. & 500 mg/kg; p.o. showed a significant inhibition in paw volume 64.56% & 73.33% respectively, standard drug diclofenac sodium (20 mg/kg; p.o.) produced 75.75 % inhibition when compared with control group.

**Histopathological studies** of hind paw joints in vehicle control rats shown intact articular cartilage and normal synovial lining. The arthritic control rat joint showed abnormalities from the normal joint like degeneration with partial
erosion of the cartilage and infiltration of inflammatory exudates in the articular surface.

The standard drug treated rat joint showed normal synovial membrane with less cellular infiltrates in articular cartilage. MRH (250 mg/kg; p.o.) and MRH (500 mg/kg; p.o.) treatment for 21 days showed less inflammatory cellular infiltrate on the articular and aggregation of inflammatory cell.

**Ipomoea eriocarpa**

*Ipomoea eriocarpa* (convolvulaceae) is a twining slender herb, which is commonly known as *Bhanwar* and *Bhanwarvel* in India. Some important morphological features for the identification of *Ipomoea eriocarpa* leaves were observed and documented herein. The leaves were alternate, simple, ovate-cordate blade, acute apex, entire margin with highly pubscent surface. Flowers were regular, pentameric. Sepals ovate, corolla tubular to funnel shaped, purple or pink with 5 hairy bands outside. Fruits globose to ovoid capsule, hairy & up to 4 seeded. Seed ovoid, brownish in colour, three sided finely punctuate and glabrous.

Microscopally, *Ipomoea eriocarpa* leaf exhibited distinct dorsi-ventral symmetry with prominent midrib. Midrib had wide U shaped adaxial groove and hemi-circular quite thick and prominent abaxial part. The vascular system consisted of a wide, bowl shaped main strand and a horizontal band of small, less prominent xylem strands. The mesophyll tissue consists of an adaxial zone of single layer of cylindrical undulate palisade cell.

**Petiole** consisted of narrow, thick walled, small epidermal cells with thick cuticle. The vascular strands were collateral, close, radial rows of xylem elements and a zone of phloem. **Stem** was circular in outline, the epidermal cells were cuboidal, uniseriate unicellular trichomes emerge out from the epidermal cells. Phloem region showed the isolated sclerids, xylem forms a
continuous cylinder it consisted of vessels of large lumen, tracheids and xylem parenchyma.

The diagnostic features of the powder were presence of unicellular trichomes, rosettes types of calcium oxalate crystal & sclerenchyma cell, fibres, multicellular head, fragments of mesophyll, paracytic stomata and reticulate xylem vessel.

Proximate analysis was performed to help setting certain standards for dried drugs in order to avoid batch-to-batch variation and to judge their quality and purity. Parameters like total ash, acid insoluble ash, water soluble ash, water soluble extractive value and alcohol soluble extractive values, elemental analysis and fluroscence anlaysis were studied under proximate anlaysis.

Alcohol soluble extractive value was higher than any other organic solvent during successive extraction for aerial parts of *Ipomoea eriocarpa* which indicated the presence of polar chemical constituents. These determinations provided an idea regarding the probable content of various inorganic metal ions as well as the nature of the constituents present. More ash value (7.67 %) indicates the presence of more inorganic matter.

Results of elemental analysis showed that potassium (4.64 %) and calcium (1.82 %) were present in highest quantities in aerial parts. Apart from this magnesium, phosphorus was present in smaller quantities in aerial parts. The contents of elements were found to be within limit.

The colour of the plant extract in UV light is mainly due to its chemical composition. The same extract may appear in different colours at different wavelength of light (254 and 366 nm) and these colors are characteristic for the particular drug or different parts of same drug. Therefore, fluorescence studies were done on powdered aerial parts of *Ipomoea erioacarpa*. 
Successive extracts were prepared by subjecting coarsely powdered plant materials to the solvents of increasing polarity viz., petroleum ether, toluene, chloroform, ethyl acetate, methanol and water. The successive extracts were subjected to various qualitative chemical tests to determine the presence of various phytoconstituents.

Qualitative tests for different extracts of *Ipomoea eriocarpa* showed maximum constituents were positive for methanolic extracts such as carbohydrates, phytosterol & triterpenoids, alkaloids, proteins and phenolic compounds. Alkaloids, flavones and fixed oil were present only in some extracts.

Thus, in continuation of our studies on qualitative analysis of secondary metabolites present in successive extracts of aerial parts of *Ipomoea eriocarpa*, thin layer chromatography (TLC) studies was performed. A complete TLC profile of the successive extracts comprises of $R_f$ values for chemical constituents present in the extracts were recorded and documented.

Two compounds IE-1 and IE-2 were isolated by column chromatography of unsaponified fraction of *Ipomoea eriocarpa* aerial parts, these isolated compounds were then subjected to determination of various physical characteristic like melting point, UV, FT-IR, $^{13}$C NMR and Mass spectra of individual’s compounds were performed to elucidate the chemical structure. Compound IEI-1 was to be identified as dammarane derivative 3β, 20β-dihydroxy-26-diethyl dammarane ($C_{32}H_{56}O_2$)

**UV:** 233.32 & 269; **FT-IR:** 3438.72, (-OH), 2924.48, 2854 (C-H stretching) 2367.71, 2336.06, 2073.77, 1742.52, 1630.42, 1497.31, 1462.24, 1401.27, 1380.84, 1115.71, 1080.45, 1027.33; **$^{13}$C NMR:** δ 77.34(3C, -OH gp) 76.70(20 C,-OH gp) 127.22, 133.12 (24C, 25C, unsaturated bond) ; **Mass:** m/z (%) 332,304, 113,111 cm$^{-1}$.

Compound IEI-2 was to be identified as dammarane derivative 3β–hydroxy 20-methyl-26 methoxy carboyl dammarane ($C_{31}H_{52}O_3$)
UV: 242.90 & 289; **FT-IR:** 3440, (-OH), 2963.68 (Asymmetrical C-H stretching) 2872.95 (Symmetrical C-H stretching), 1760.48 (C=O,-COOH or ester), 1202.46 (-OCH$_3$); $^{13}$C NMR: $\delta$ 77.32 (3C,-OH group) 128.8, 133.06 (21C, unsaturated carbon) 168.20(23C, ester group.); **Mass:** m/z (%) 332,304, 113, 111 cm$^{-1}$.

HPTLC finger printing profile of the extract for both polar and non polar compounds has been developed. R$_f$ values and the relative percentage of the separated compounds were recorded.

Acute toxicity was studied on methanolic extract of *Ipomoea eriocarpa* aerial parts (MIE) orally by ACUTE TOXIC CLASS METHOD (OECD GUIDELINES 423) with a starting dose of 2000mg/kg body weight for all the extracts which showed no mortality when it was observed for 72 hours. And at the end of 3 days, as it showed no mortality the same dose was repeated for the same set of experiment and again it showed no mortality. So, the LD50 cut off was grouped under category X and it was classified under group X (unclassified group) according to GHS system for classification of toxic chemicals. Thus, acute toxicity revealed the non-toxic nature of the methanolic extract of *Ipomoea eriocarpa* aerial parts (MIE). There was no lethality or any toxic reactions found at any of the doses selected until the end of the study period.

In **hot plate method** MIE extract significantly increased the reaction time of the animals towards the thermal source in a dose dependent manner. MIE 250 mg/kg; p.o. & 500 mg/kg; p.o. showed a pain inhibition of 69.36 % (p <0.01) & 145.35 % (p< 0.01) respectively, standard drug pentazocine (10 mg/kg; Sc.) produced 262.93 % (p< 0.001) inhibition when compared with control group.

In **carrageenan induced paw edema** is a biphasic response. The first phase is mediated through the release of histamine, serotonin and kinins whereas the second phase is related to the release of prostaglandin and slow reacting substances. The MIE extract produced dose dependent and significant
inhibition of carrageenan-induced paw edema. MIE 250 mg/kg; p.o. & 500 mg/kg; p.o. showed a significant inhibition in paw volume (49.42%) & (68.17%) respectively, standard drug diclofenac sodium (15 mg/kg; p.o.) produced 82.89 % inhibition when compared with control group.

In **Freund’s adjuvant induced arthritis** body weights were found to be significantly decreased in control rats (18.87 %) on day 21\textsuperscript{st}. Treatment with MIE 250 mg/kg; p.o. (13.87 %) & 500 mg/kg; p.o. (12.48 %) showed significant change in body weight as compared to control rats on day 21\textsuperscript{st} that was comparable to standard drug diclofenac sodium (20 mg/kg; p.o.)(10.08 %)

The increased biochemical parameters SGOT, SGPT and ALP level in serum were significantly prevented with the concomitant treatment of MIE extract at dose level of 250 mg/kg; p.o. & 500 mg/kg; p.o. and diclofenac sodium (20 mg/kg; p.o.).

The erythrocyte sedimentation rate (ESR) level which was markedly elevated in arthritic control group (13.16 mm/hr) of rats was decrease significantly with MIE 250 mg/kg; p.o. (12.43 mm/hr) and 500 mg/kg; p.o. (11.87 mm/hr) dose and the effect was comparable to standard drug diclofenac sodium (20 mg/kg; p.o.)(10.5 mm/hr)

Treatment with MIE orally at 250 mg/kg & 500 mg/kg dose level showed significant lower value of arthritic index 2.84 & 2.58 as compared to control animals (4.78).

In **Freund’s adjuvant induced paw edema** the MIE extract produced dose dependent and significant inhibition of paw edema volume. MIE 250 mg/kg; p.o. & 500 mg/kg; p.o. showed a significant inhibition in paw volume  63.53% & 69.55% respectively, standard drug diclofenac sodium (20 mg/kg; p.o.) produced 75.75 % inhibition when compared with control group.

**Histopathological studies** of hind paw joints in vehicle control rats shown intact articular cartilage and normal synovial lining. Distorted articular
cartilage and inflamed cells like lymphocytes and eosinophiles were abundant at synovial lining with arthritis control rats. MIE 250 mg/kg; p.o. has shown mild inflammatory condition at synovial lining. However, the standard diclofenac sodium (20 mg/kg; p.o.) and MIE 500 mg/kg; p.o. has maintained intact articular cartilage and has reduced the number of inflamed cells like lymphocytes and eosinophiles as compared to arthritic control.

CONCLUSION

- The selected plants *Rivea hypocrateriformis* and *Ipomoea eriocarpa* were successifully evaluated for their correct identity by studying their pharmacognostic features.

- Parameters like, ash value, extractive value, loss on drying, elemental analysis was determined, as per WHO guidelines, for assessing their quality standards.

- Bergenin was isolated from the leaves of *Rivea hypocrateriformis*, whereas three other compounds such as 4-hydroxy 2H-chromene-2-one (4-hydroxy coumarin), 6-O-demethylsalutaridine and 3-(benzimidazol-2-yl)-7-(diethyl amino) chromen-2-one were first time isolated from leaves of *Rivea hypocrateriformis*.

- Two dammarane derivateves 3β, 20β-dihydroxy-26-diethyl dammarane & 3β–hydroxy 20-methyl-26 methoxy carboyl dammarane were first time isolated from *Ipomoea eriocarpa* aerial parts.

- Validated HPTLC method was developed for quantification of bergenin in leaves of *Rivea hypocrateriformis*.

- HPTLC finger printing profile of *Ipomoea eriocarpa* aerial parts extract for both polar and non polar compounds was developed.

- Biological studies of methanolic extracts of *Rivea hypocrateriformis* leaves & aerial parts of *Ipomoea eriocarpa* possess good potential for
analgesic, anti-inflammatory and anti-rheumatic activity. These results could be attributable to the presence of coumarin and phenolic compounds present in methanolic extract of *Rivea hypocrateriformis* and presence of triterpenoids, flavonoids and phenolic compounds in methanolic extract of *Ipomoea eriocarpa*.

- Hence, through the present studies on both the selected plants, *Rivea hypocrateriformis* leaves & *Ipomoea eriocarpa* aerial parts, their phytopharmacological evaluation could be validated to a reasonably level. The results can be used as scientific validation for both the plants regarding their uses mentioned in traditional literature.

Based on comprehensive therapeutic characteristics associated with *Rivea hypocrateriformis* and *Ipomoea eriocarpa* can be utilized for treatment of ailments like rheumatism and inflammation or can be included as an ingredient for antirheumatic herbal preparations after further studies on development of its proper formulation and confirmation for its clinical efficacy.