7. SUMMARY AND CONCLUSION

Parpata is a common name used for different Indian medicinal plants namely, *Oldenlandia corymbosa*, *Rungia repens*, *Mollugo oppositifolia*, *Fumaria parviflora* and *Polycarpaea corymbosa*. Its important formulations are Amrutaristam, Chandanasavam, Mahatiktaka Ghrtam, Jatyadi Tailam, Nalpamaradi Tailam, Sudarshana Curna, Pacanamrt Kwatha Curna, Parpatadi Kwatha etc. In Ayurvedic text parpata is indicated to be useful in the treatment of fever, jaundice, skin disease, burning of body, wandering of mind etc.

All the aforementioned plants were studied to establish quality standards and further this is also the first report on development of validated HPTLC method for each of these plants. Pharmacognostic study of *O. corymbosa*, showed that it is a prostrate herb with lanceolate leaf and white flowers; specific anatomical features, of root include radiating xylem and narrow phloem traversed by uniseriate medullary rays; drum shaped epidermal cells, narrow cortex and stellar region of stem; and collateral meristele and idioblasts containing raphides of calcium oxalate in leaf. Pollen grains, papillose epidermis of corolla and raphides are idiosyncratic characters of powdered plant. HPTLC methods (validated) were established for the estimation of oleanolic acid, ursolic acid, lupeol and stigmasterol using silica gel 60 F254 plates as a stationary phase and hexane: ethyl acetate: methanol (8.2: 1.8: 0.5, v/v) and toluene: methanol (9.4: 0.6, v/v) as the mobile phases for oleanolic acid and ursolic acid; and for lupeol and stigmasterol respectively. The quantitation of the four markers was carried out using the densitometric scanning at 545 nm after derivatization using sulfuric acid reagent. The contents of oleanolic acid, ursolic acid, lupeol and stigmasterol were found to be 0.012±0.006, 0.053±0.009, 0.026±0.008, and 1.19±0.04% w/w respectively.

Morpho and microscopical studies on *R. repens* revealed that it is a prostrate herb with lanceolate leaf and violet flowers; collenchymatous phloem associated with wide lignified radiating xylem in root; epidermis with simple and glandular trichomes and collenchymatous hypodermis in stem; and epidermis embedded with cystoliths and bearing covering and glandular trichomes in leaf. Attributes of powdered plant
material include cystoliths, trichomes of aforementioned type, pollen grains and fragments of cork. Validated HPTLC method developed for quantification of kaempferol using toluene: ethyl acetate: dichloromethane: formic acid: methyl ethyl ketone (5:1: 1.5: 0.5: 0.8, v/v) as a mobile phase and scanning the plate at 254 nm suggested 0.15±0.06% w/w of kaempferol.

Physical evaluation of *M. oppositifolia* indicated that it is a prostrate herb with linear-lanceolate leaf and white flowers; microscopically root can be characterized by crescent shaped phloem associated with continuous or discontinuous rings of xylem; stem by epidermis bearing multi-cellular simple and glandular trichomes, and sclerenchymatous pericycle; and leaf by continuous band of a palisade cells and, rosettes and prisms of calcium oxalate throughout parenchyma. Powdered drug can be distinguished by multi-cellular trichomes, fragments of epidermis of leaf in surface view, epidermis of corolla and entire or broken seeds. Oleanolic acid and lupeol content was found to be 0.028±0.015% w/w and 0.016±0.002% w/w respectively when estimated by newly developed simultaneous HPTLC method using toluene: methanol (9.4: 0.6, v/v) as a mobile phase and scanning the plate at 545 nm.

Botanical evaluation of *F. parviflora* tagged it as a diffuse, annual herb with thin winged stem; alternate leaf finely divided into small, linear lanceolate segments, small white or pink flowers with purplish tips. Histologically roots are typified by the presence of centrally located diarch primary xylem encircled by wide secondary xylem occupying major area and a narrow cork; stem by collenchymatous hypodermis, vascular bundle capped with lignified pericyclic fibres and hollow pith; leaf by vascular bundles with groups of sclerenchyma underneath the phloem and narrow spongy parenchymatous lamina. Distinguished features of powdered plant material are xylem vessels with varied thickening, lignified and thick walled testa, and spherical pollen grains. Amount of protopine and β-sitosterol was 0.49±0.03% w/w and 0.25±0.12% w/w respectively, when estimated by validated HPTLC methods separately, using toluene: ethyl acetate: diethyl amine (7: 2: 1, v/v) and toluene: methanol (9.4: 0.6, v/v) as a mobile phase respectively.

Apparent external features of *P. corymbosa* are branched, erect or spreading stems with linear leaf and silvery-white cymes. The peculiar internal structures are
continuous or discontinuous concentric rings of xylem and phloem in root; papillose epidermis with multicellular branched collapsed and glandular trichomes, sclerenchymatous pericycle, and hollow pith in stem; and numerous collateral meristeles enclosed within parenchymatous bundle sheath in leaf. Powder can be identified by rosettes of calcium oxalate, branched and collapsed trichomes, and pollen grains. Validated HPTLC method was developed for estimation of lupeol using same mobile phase as in *O. corymbosa*. The quantity of lupeol in entire herb was estimated to be $0.012 \pm 0.007\%\text{w/w}$ on dry basis.

The proximate analysis of all plants performed separately, revealed that brunt of heavy metal and microbial loads were within permissible limits.

The data and monographs generated can be used as botanical reference standards for the drugs commonly known as parpata. Further, the HPTLC method developed for each plant is easy to operate, reproducible and economical.