CHAPTER 7

Summary and Conclusion:

In phytosciences, instead of testing a hypothesis, researchers try to conclude whether plants commonly used in traditional system of medicine provides benefits for health and, if so, what are their mechanisms of action. Amaranth is a highly nutritious food. The leaves, shoots and tender stems are utilized by human and animals as food.

The present study is aimed at phytochemical investigation and pharmacological studies like antioxidant, alpha amylase inhibition assay, antipyretic, analgesics, anthelmentic, antimicrobial and laxative of leaves of *Amaranthus spinosus*, whole plants of *Amaranthus caudatus* and *Amaranthus viridis*.

The total ash value of *A. viridis* was found to be lesser than *A. spinosus* and *A. caudatus*. The acid insoluble ash and water-soluble ash were more in *A. spinosus* than *A. caudatus* and *A. viridis* respectively. Glandular trichome observed in *A.spinosa* and *A.caudatus* and *A.viridis* contains covering trichomes.

The phytochemical examination of methanol extracts *A. spinosus*, *A. caudatus* and *A.viridis* revealed the presence of alkaloids, steroids, glycosides, flavonoids, phenolic compounds, saponins, proteins and carbohydrates. The total phenolic content
of Methanolic extract of *A.caudatus* is more compared to *A.spinosus* and *A.viridis*.

HPTLC finger print of Methanol extracts of amaranthus showed the presence of flavonoids. MeAc and MeAs showed better antioxidant property than MeAv according to the HPTLC report.

Rutin and quercetin content in the methanol extracts of each plant was estimated by HPLC. All the three plants showed almost same percentage of rutin and quercetin.

Methanolic extract of *A.caudatus* showed potent scavenging activity compared to *A. spinosus* and *A.viridis* in DPPH, NO, SOD, ABTs methods, while methanolic extract of *A.spinosus* possess significant hydroxyl scavenging activity was noted than that of methanolic extract of *A.caudatus* and *A.viridis*.

Methanolic extract of *A.caudatus* showed maximum alpha amylase inhibition activity when compared to methanolic extract of *A.spinosus* and *A.viridis*. Methanolic extract of *A.spinosus* showed potent inhibition of hemoglycosylation than methanolic extract of *A.caudatus* and *A.viridis*.

Animals showed good tolerance to single dose of extracts (methanolic extract of *A.spinosus A.caudatus* and *A.viridis*) at 2000 mg/kg and were non-lethal. Highest dose did not produce any noticeable behavioral changes or mortality when observed for 14 days after administration.
Methanol extracts of three plants were significantly (P<0.01) reduced writhing and stretching induced by 0.6 % acetic acid at dose of 10 ml/kg. Dose dependent analgesic activity was noted with the extracts at the 200 and 400 mg/kg dose levels, which was comparable to that of diclofenac sodium (50 mg/kg).

Methanol extracts of three plants showed analgesic activity using hot plate test in mice. Methanolic extract of *A.spinosa* showed maximum analgesic activity compared to methanolic extract of *A.caudatus* and *A.viridis*. At 200 and 400 mg/kg of methanol extract showed significant analgesic activity (P<0.01) until the end of the experiment, which was comparable to the effect of standard Morphine 5 mg/kg.

Results indicates significant (P<0.01) analgesic activity of methanol extracts of three plants, in dose dependent-manner reduces the painful sensation in rats due to tail immersion in warm water when compared to Morphine. The inhibitory effect was prominent between 30 and 240 sec after administration of extracts at dose of 200 and 400 mg/kg respectively.

Methanolic extract of *A.spinosa*, *A.caudatus* and *A.viridis* at 400 mg/kg dose showed significant antipyretic activity (P<0.01). At 200 mg/kg dose, Methanolic extract *A.viridis* showed significant antipyretic activity at 21 and 22 h where as *A.spinosa* is significant (P<0.05) at 22 h and *A.caudatus* was significant (P<0.01
and $P<0.05$) at 22 h and 23 h. The antipyretic effect of Methanolic extract of *A.spinosus*, *A.caudatus* and *A.viridis* at 400 mg/kg is similar to the paracetamol group.

The Methanolic extract of *A. spinosus*, *A. caudatus* and *A. viridis* significantly ($P<0.01$) increased propulsion of the charcoal meal through the gastrointestinal tract. Senna produced significant ($P<0.01$) gastrointestinal motility. *A.caudatus* showed maximum contraction response when compared to *A.viridis* and *A.spinosus* at concentration 80 µg/ml.

Methanolic extract of *A. spinosus* is significant ($P<0.05$) at the dose of 50 mg/kg (p.o.) compared to *A.caudatus* and *A.viridis*. Methanolic extract of *A. spinosus*, *A. caudatus* and *A. viridis* at dose of 100 mg/kg (p.o.) increased significantly ($P<0.01$) fecal output of rats compared to control group.

Methanol extracts showed significant ($P<0.01$) anthelmintic activity. MeAs showed potent anthelmintic activity compared to MeAc and MeAv. The earthworms were more sensitive to the methanol extracts of *A. spinosus*, *A. caudatus*, and *A.viridis* as compared to the reference drug piperazine citrate.

The antimicrobial activity of methanol extracts of amaranthus were tested by paper disc diffusion method against five pathogenic bacteria *E. coli*, *S.aureus*, *B. subtilus*, *Streptococcus*, and *K. pneumonia*. The highest antimicrobial potential was
exhibited by methanol extract of *A. caudatus* followed by *A. spinosus* and *A. viridis*.

Flavonoids and phenolic compounds have been reported to have multiple biological effects such as antioxidant activity, analgesic, anti-inflammatory, inhibition of mast cell histamine release antiulcerogenic, cytotoxic, antihypertensive, hypolipidemic, antiplatelet and neurodegenerative diseases, antiallergic and inhibitory action on arachidonic acid metabolism as demonstrated by *in vitro* and *in vivo* tests. There are also reports on analgesic effects of alkaloids sterols and triterpenoids.

From the studies carried out, it is evident that, all the three plants (i.e *Amaranthus spinosus*, *Amaranthus caudatus*, and *Amaranthus viridis*) are endowed with significant antioxidant, alpha amylase inhibition, hemoglycosylation, analgesic, antipyretic, effect on gastrointestinal tract, antimicrobial and anthelmintic activities may be due to presence of phytochemicals like flavonoids, tannins, steroids, saponins, cardiac glycosides and amino acids, there by justifying their use in the traditional system of medicine.