Zingiberaceae, one of the largest family of the order Zingiberales, is rich in plants containing essential oils. Rhizomes of many species are used in indigenous system of medicine for a variety of purposes. They are ingredients of various indigenous prescriptions for consumption, dyspepsia, bronchitis, asthma and as carminative, stomachic aphrodisiacs, febrifuge, anti-inflammatory and analgesic etc.

Rhizomes of *Zingiber* species are important articles of commerce and considerable work has been done on one of its species *Z. longa*. Although the other species of this genus have been subjected to some chemical and antimicrobial studies, they do not seem to have been studied from the angle of their indigenous uses. Rhizomes of *Kaempferia rotunda* and *Alpinia galanga* are also of medicinal value. Procurement of all these rhizomes usually involves problems of authentication.

The present study was undertaken with a view to evaluate the rhizomes of some of the species of *Zingiberaceae* for their medicinal properties and to evolve standards for their authentications. The plants selected for these studies are *Kaempferia rotunda*, *Curcuma xzma*, *Curcuma xanthotricha*.
*Furnace acacia*, *Furnace redwood* and *Alvine valence*.

The macroscopic and microscopic studies of the rhizomes were undertaken with a view to identify them as whole or as in powdered form. The macroscopical characters of the rhizomes are not much helpful in characterising, but the microscopic characters, particularly the variations in the size of various cells can be used as diagnostic features. Starch grains in the rhizomes differ considerably in size, shape and relative abundance in different species. The presence of needle shaped crystals of calcium oxalate distinguishes the rhizomes of *L. acacia* from those of others. The rhizomes of *L. unguiculata* can be identified by the presence of relatively fewer number of oil cells. All the microscopic measurements taken together can definitely be of help in establishing the identity of rhizomes beyond reasonable doubt.

Proximate analysis of the rhizomes was carried out. The total and sulphated ash values were high in case of rhizomes of *L. acacia*, *L. redwood* and *L. zonina* indicating the presence of considerable amount of inorganic matter. The alcohol and water soluble extractive values were highest in the case of *L. valence* and lowest in the case of *L. acacia*. The ash and extractive values cannot be used as diagnostic features since the differences in them are not marked. They may, however, be helpful in the identification when taken into consideration along with the macroscopic and microscopic
characters. Successive solvent extraction with different solvents was carried out and the extracts were tested for common plant constituents. None of the rhizomes exhibited the presence of alkaloids, glycosides and saponins, etc., but flavones were found in *K. rotunda*. All the rhizomes contain starch, proteins and free amino acids, and yielded essential oil on hydrodistillation.

The rhizomes of *K. rotunda*, *G. amrana*, *G. amygdaliflua*, *G. cascaria*, *G. novaloaia* and *A. salana* yielded 0.33% 1.6%, 0.01%, 1.45%, 0.60% and 0.30% of essential oil respectively. The yield of essential oil of *G. amygdaliflua* was very low, therefore, further studies on its essential oil could not be undertaken.

The essential oils of *G. cascaria* and *A. salana* were dextrorotatory, whereas that of *K. rotunda*, *G. novaloaia* and *G. amrana* were laevorotatory. The various physicochemical properties taken together may help in the identification of essential oil of the rhizomes.

The isolated essential oils were subjected to thin layer chromatography (TLC) on silica gel '60'. Hexane, Ethyl acetate (9:1) and Benzene : Ethyl acetate (9:1) gave best resolution. Co-chromatography with authentic samples was also performed. The component identified by the two solvent systems differed indicating that none of them was successful in resolving all the components. The essential oils were,
therefore, subjected to gas liquid chromatography (GLC) on
AMIL Gas Chromatograph using S.E. 30 as absorbent and nitrogen
as carrier gas. Various probable components were also fed to
the column simultaneously to identify components of essential
carrier. The percentage of the components was calculated on the
basis of the area of the peaks. The composition of essential
carrier according to GLC analysis is as under:

*L. rutacea*

46.13% - Caryophyllene; 19.72% - Caryophyllene oxide;
11.43% - 3-Cymene; 10.23% - Linalool; 0.38% - Helanol;
1.01% - 1,3-Cineole; 1.0% - Lironene; 0.90% - -Epinene;
0.60% - Cedrene; 0.23% - a-Camphor; 0.20% - Bornanol;
0.24% - Methyl cinnamate.

*L. amara*

40.42% - Bornanol; 25.46% - Caryophyllene; 16.49% - Helanol;
15.30% - Cymene; 2.48% - e-Cymene; 1.84% - -Epinene and
0.82% - Lironene.

*L. cepasa*

60.19% - Bornanol; 17.92% - Helanol; 11.95% - Lironene;
4.42% - -Epinene; 2.68% - e-Cymene; 1.77% - Caryophyllene;
1.79% - 1,3-Cineole.
C. occidentalis

44.70% - α-Fenchene; 35.79% - α-Camphor; 10.49% - Methyl cinnamate; 8.59% - δ-3-Carene; 1.16% - α-Terpinol; 0.53% - 1-ex-Tumerene; 0.63% - Cedrene; 0.43% - Camphene.

A. ceylanum

51.22% - Methyl cinnamate; 29.29% - Cedrene; 8.49% - Caryophyllene; 3.28% - β-Fenchene; 1.25% - α-Fenchene; 2.24% - α-Camphor; 1.07% - δ-3-Carene; 1.25% - β-Cymene; 0.13% - 1-ex-Tumerene; 0.25% - δ-3-Carene; 0.75% - Emyyl acetate.

The pharmacological investigations of all the essential oils were carried out to evaluate the drugs for uses endowed to them in various system of medicine. Acute toxicity studies indicated that none of the essential oils produce any mortality up to a dose of 300 mg/kg. The essential oils produced a depressant effect in the doses of 75 mg/kg and 150 mg/kg. The essential oil of C. rotundifolia produced maximum depression. The essential oils of C. ambra, C. anessia, C. occidentalis and A. ceylanum were similar in action, differing only in the degree of depression. The essential oil of A. ceylanum was least active.

All the essential oils produced hypothermia in rabbits. The essential oil of A. ceylanum which was most active caused
a fall of 4.207 in the case of 75 mg/kg. All the essential oils potentiated pentoobarbitone-induced hypnosis. The essential oil of \textit{L. rotunda} was most effective followed by essential oil of \textit{L. salmuera}. \textit{L. suaveolens}. The potentiation of hypnosis was not significant in case of essential oil of \textit{L. rotunda} and \textit{L. suaveolens}. The rotated performance of albino rats was not affected by any of the essential oils. The essential oils did not also exhibit significant analgesic activity.

The essential oils produced a fall in blood pressure of anaesthetised dog and increased the respiration reflexly. Recovery was prompt and complete. The oxytocin induced responses on isolated uterus of rats were not altered by the essential oils. The contractile effects of histamine on isolated lung strip of dog were neither combated nor blocked by the essential oils. The essential oil did not significantly block the histamine induced spasm on isolated tracheal chain of dog; however, the essential oil of \textit{L. spinosa} and \textit{L. rotunda} controlled the spasm intensity to half. All the essential oils reduced the carrageenan induced inflammation in albino rats and inhibited implantation in female rats.

The essential oils were screened for insecticidal activity against \textit{L. oxymus} by thin film application method. \textit{L. spinosa} and \textit{L. rotunda} showed promising activity. The other essential oils were also active, but the activity was
not significant. The essential oils were screened for juvenile hormone mimicking activity against *A. homoei*. The essential oil of *E. obtusa* exhibited maximum activity, the activity of essential oil of *E. amada* was also significant while other essential oils did not show significant activity.

The rhizomes of *E. obtusa*, *E. enantiafolia*, *E. amada*, *E. equina*, *E. vedanwa* and *A. salana* yielded 39.28%, 57.32%, 8.12%, 7.24%, 39.13% and 46.21% starch respectively. The microscopical and physical characters such as true density, bulk density, flow time etc., were studied. The starches were also studied from a view point of pharmacopoeial requirement.

The starches of *E. amada* and *E. vedanwa* could not be taken up for pharmaceutical studies as their yield was low and they were slightly coloured.

The viscosity studies were carried out with the maillages prepared with starch of *E. obtusa*, *E. enantiafolia*, *E. vedanwa* and *A. salana*. The viscosity of *E. enantiafolia* was comparable to maillage prepared with maize starch. The binding, lubricating and disintegrating properties of the isolated starches were studied by preparing granules and tablets of diaspor. The starches of *E. enantiafolia* and *E. obtusa* compared favourably with maize starch.

The essential oils of the rhizomes particularly *A. salana* can be utilised in therapeutics as febrifuge.
The C. sativa depressant properties of the essential oils when looked in the light of their hypotensive properties provide scope for further investigation. The anti-inflammatory property, although not very significant in comparison to the drugs used in modern system of medicine justify the use of these rhizomes for this purpose in the indigenous medicine. The pharmacological investigations of different component of the essential oils may lead to interesting results. The essential oils of L. rotundus and L. canda hold some promise as the insectical and juvenile hormone mimicking agents. The starches of C. angustifolia and L. rotundus can be considered for use as alternative source of starches in pharmaceutical formulations.