CHAPTER-I

INTRODUCTION
The vegetables rank next to cereals as source of carbohydrates. The nutritive value of vegetable is tremendous because of the presence of indispensable minerals, salts and vitamins. India grows a large variety of vegetables belonging to tropical, subtropical and temperate groups. The daily minimum requirement of vegetables, according to dietician is 284gm of per head i.e. about 20% of the daily requirement of the total food of an adult. The requirement is more in case of vegetarian diet. The present supply is only about one fourth to one third of the requirement. This object can be achieved by increasing the area under cultivation and also by increasing the yield per unit area by adopting better agricultural techniques and disease management devices.

Vegetable crop and belonging to family cucurbitaceae have a world-wide distribution and provide maximum fruit vegetables of daily requirement. Cucurbits are good source of vitamins and minerals. Instead of vegetables some cucurbits are used in preparation of sweets also. Seeds are edible and also yield an edible fixed oil. Shell is also used as water bottle, bowl and in preparation of musical instruments by traditional people.

_Cucurbita moschata_ (Duch.) commonly known as Kaddu, belongs to family Cucurbitaceae of Angiosperms and is extensively grown in India and more specifically in eastern Uttar Pradesh. Cucurbits are among one of the most important vegetable crops and constitute about 50% of the total vegetable crop production. Vegetables constitute an important part of the human food as they are a rich source of carbohydrate, proteins, vitamins, and minerals and many other useful components. A kitchen garden without a cucurbit is supposed to be incomplete in every corner of the world. A large
number of cucurbits *viz.* Ash gourd (*Benincasa hispida* Thumb. Cong.) Khabha, Bottle gourd (*Lagenaria siceraria* Mol. Standl.) Lauki, Bitter gourd (*Momordica charantia* L.) Karela, Cucumber (*Cucumis sativus* L.) Kheera, Long melon (*Cucumis melo* L. var. *utilissimus*) Kakri, Musk melon (*Cucumis melo* L.) Kharbboja, Pointed gourd (*Trichosanthes dioica* L.) Parwal, Pumpkin (*Cucurbita moschata*, *Cucurbita maxima* Duch.) Kaddu, Round gourd (*Citrullus vulgaris* Schrad var. *fistulosus*) Tinda, Ridge gourd (*Luffa acutangula* Roxb.) Kali tori, Snake gourd (*Trichosanthes anguina* L.) Chichanda, Snap melon (*Cucumis melo* L. var. *monordica*) Phoot, Sponge gourd (*Luffa cylindrica* Roem.) Ghiya Tori, Squash (*Cucurbita pepo* L.) Kaddu and Watermelon (*Citrullus lanatus* Thumb mansf.) Tarbooj are cultivating in every part of our country. In India, nearly all cucurbits are grown in various regions of the country predominating region being western and north-east. Among states, Rajasthan provides the maximum potential for cucurbits production because of its best suited agro-climatic conditions. All cucurbits are annuals, except pointed gourd (*Trichosanthes dioica* – Parwal) and small gourd (*Citrullus vulgaris* var. *fistulosus* – Tinda) which are perennials. All cucurbits are propagated through seed and some are propagated by cutting. Among all the cucurbits *Cucurbita moschata* commonly known Kaddu, is very important cucubit crop. This crop is heavily damaged by CMV and characterized by symptoms of typical mosaic mottling, vein banding, vein clearing, stunting and chlorosis, that has effected productivity, and finally destroying whole *Cucurbita moschata* plants.

The climatic, edaphic condition, inter-cultural requirements and irrigation methods for all these cucurbits are more or less the same. They require a warm and dry weather, good sunshine, low
humidity and frost free area for good growth, flowering and fruiting. Partial change in climate may precipitate the occurrence of the diseases. Different types of pathogenic agents like bacteria (Angular leaf spot of cucumber caused by *Pseudomonas maculicola*um (mec.) stev. And wilt disease of cucurbits caused by *Bacillus tracheiphilus*) and fungi (Downy mildew, Powdery mildew and Soft rot are caused by *Plasmophora, Erysiphe* and *Pythium* respectively) attack cucurbits. But among all the pathogens the virus diseases are very important as they causes heavy loss of yield and its production.

The environmental factors that influence plant disease (epidemics or epiphytotics) are moisture, temperature, wind and the nature of soil and so forth. The other factor, include those which affect host-parasite relationships and determine the spread of the disease through a host population. Dispersal of viruses by air, vectors, seed, pollen, soil borne vector and over long distances by human activates play vital role in the epidemiology of the virus diseases.

Important aphid vectors are the green peach aphid (*Myzus persicae* Sulzer) and the cotton or melon aphid (*Aphis gossypii* Glover). Both species transmit cucumber mosaic virus (CMV). These aphids are always present in pumpkin fields in eastern Uttar Pradesh and are found to be responsible for virtually CMV transmission in cucumber. Therefore, present investigations are concerned with CMV.

As a matter of fact, it appears that in north India cucurbits are mainly grown along the river beds between the months of October and June. The first cucurbits to be sown are usually musk melon and water melon as fruits and of course, in vegetables, squash, pumpkin and bottle gourd rank second to none. In these crops major diseases
are caused by Cucumber Mosaic Virus (CMV), Water Melon Virus (WWV) and alike viruses e.g. Benincase Mosaic Virus (BMV), Trichosanthes Mosaic Virus (TMV), Pumpkin Mosaic Virus (PMV) by the end of their growing seasons. Nearly 100% disease incidence of CMV has been reported in squash, pumpkin and bottle gourd, 80% in the musk melon and 75% in water melon (Raychaudhuri and Verma, 1978; Rao and Verma, 1984; Vani and Verma, 1988a; Verma and Giri, 1993).

Viruses hold top position among pathogens as they cause heavy infection on economically important cucurbitaceous crops. Viruses and their strains which affect the yield to a great extent are Tobacco Mosaic Virus (TMV), Tobacco Ring Spot Virus (TRSV), Aster Yellow Virus (AYV), Yellow Vein Mosaic Virus (YVMV), and cucurbit viruses. The first virus disease reported on cucurbits in India was the mosaic of *Momordica charantia* (Uppal, 1933), since then, several viruses have been reported as pathogen on different cucurbits e.g. cucumis virus, watermelon mosaic virus, squash mosaic virus, melon mosaic virus, etc. Cucumber Mosaic Virus (CMV) has been reported to occur on Cucumber (Bhargava and Joshi, 1960) and Pumpkin (Reddy and Nariani, 1963). Pumpkin has also been found to be infected with yellow vein mosaic virus (Verma, 1955).

During the survey of the cucurbits growing in fields of Bahraich, Shrivasti, Gonda and Balrampur districts of Devipatan division, the diseased plants of Kaddu, *Cucurbita moschata* (Duch.) were observed to be showing typical symptoms of mild mosaic, stunting, vein banding, vein clearing and chlorotic spots. These symptoms were more prominent in the Kaddu, *Cucurbita moschata* plant particularly, facilitating the establishment of diagnosis of the
disease and affected plants exhibited much reduction in yield of the crop. It is neither hypothetical nor exoneration to say that symptomatological based approach is the only effective way, from practical agricultural point of view, by which a viral disease can be identified in the field. Three virus isolates showing different symptoms were noticed on almost all cucurbitaceous plants.

The frequency and severity of occurrence of viral diseases on *Cucurbita moschata* had an added advantage from research and academic point of view of having ample amount of virus within short period of time and a matching similarity with CMV. Utilizing these unique qualities, the host *Cucurbita moschata* (Duch.), a sensitive plant for viral disease propagation was taken as host to study the various altered metabolic activities.

Various macroscopic and macroscopic symptoms of the disease might originate due to biochemical aberrations induced directly or indirectly by the virus. Taking into consideration the wide prevalence and severity of the disease, the present investigation was under taken to study the virus-vector relationships and the deviation in metabolism of *Cucurbita moschata* (Duch.) after inoculation with three strains of Cucumber mosaic virus (CMV) particularly concentrating on moisture and dry matter content, chlorophyll, enzymatic activities, carbohydrate, nitrogen, protein and mineral content etc. A few medicinal plants were used to effective control of the diseases caused by virus in this economically important crop.

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