DISCUSSION

Seed mycflora associated with seeds of sesame (Sesamum indicum L.) was studied with particular reference to Macrophomina phaseolina (Rassi) Gooid., Corynespora cassicola (Berk & Curt) W. & A., Alternaria sesami (Kawamura) Mohanty & Behera., in samples collected from Bundelkhand region viz; Jhansi (25), Jalaun (15), Hamirpur (10), Banda (10), Lalitpur (15), Chhatarpur (5), Panna (5), Tikamgarh (5), Sagar (10), Ramoh (5) and Datia (15) along with their effect on the seed germination. Percent association of seed borne fungi was low in the seeds treated with Tiloram (0.3 per cent) as compared to untreated seeds from all the places. Seed mycflora generally consisted of Alternaria sp., Alternaria alternata (Fr.) Keissler, A. sesami, Aspergillus sp., Botrytis cinerea Pers. ex. Fr., Cephalosporium sp., Chaetomium sp., Corynespora cassicola, Curvularia lunata (Wakker) Boedijn., Fusarium sp., F. oxysporum Schl., F. equiseti (Corda) Sacc., F. semitectum Berk & Curt., F. moniliforme Sheldon., Haplosporangium sp., N. phaseolina, Mycosphaerella sp., Penicillium sp., Phoma sp. and Phialophora sp. in these samples. The pre-dominant fungi
were, *A. phaseolina*, *G. cassicola*, and *A. sesami*. The germination percentage of the seeds was improved in the treated seeds. The presence of *A. phaseolina* was 142 per cent in Chhatarpur, 100 per cent in Tikamgarh and Dausa and with minimum 24.40 per cent in Jhansi. The fungus *G. cassicola* showed the highest percentage of prevalence (82 per cent) in Chhatarpur followed by 44 per cent in Panna and Tikamgarh, with minimum prevalence as 14.22 per cent in Jalaun. *A. sesami* exhibited 40 per cent as the highest prevalence in Tikamgarh followed by 36 per cent in Panna and Chhatarpur districts with lowest as 1.3 per cent in Jhansi. The occurrence of these major fungi was comparatively more in the districts of Madhya Pradesh than to Uttar Pradesh. A direct correlation of the associated mycoflora existed with the seed germination percentage.

For quick determination of the presence of seed mycoflora in a particular place, the five samples were randomly selected and examined to corroborate with the over all existed picture of the seed mycoflora. It was found that pretreated seeds were low in mycoflora than to untreated seeds. The order of dominance of three main fungi *A. phaseolina*, *G. cassicola*, and *A. sesami* was in
according to their high association percentage. The percentage seed germination also agreed with the previously observed germination percentage being high in treated seeds and low in untreated seeds.

It is interesting to note that the seed mycoflora was quite different with sunflower (Helianthus annuus L.), the other oil seed crop of the country (Agarwal and Singh, 1974) including M. phaseolina which was also not detected from soybean seeds by Schneider et al., (1974), while few fungi were common with the seed mycoflora of soybean (Agarwal et al., 1972); although, M. phaseolina has been reported with seeds of cowpea (Singh & Chohan, 1974; Sinha & Khare, 1977). Many of the fungi associated with sesame seeds have been listed by Noble & Richardson (1968).

Several methods have been proposed for seed testing for the association of seed borne fungi, of these blotter method and agar plate method are commonly applied in routine tests. The blotter method proved more efficient in detecting the seed borne fungi from these samples than the P.D.A. method, similar observation was made by
Agarwal et al., (1972) in case of seed borne fungi of rice, wheat, blackgram, greengram and soybean in India. The problem of quick growing saprophytes adhering to the seeds under P.D.A. method was in accordance to the earlier observations made by de Tempe (1961).

The look of sesameum seeds is generally spoiled by the associated micro-organisms. Seed samples collected from open market could be conveniently classified into four distinct categories vis; category I, healthy looking seeds; category II, brown coated seeds; category III - badly deformed with wrinkled seed coat and category IV - seeds infected with M. phaseolina. About 37 per cent seeds were found affected by one or the other reasons listed in category II to IV. The seed weight of the affected seeds showed a gradual decline from the seed weight of the healthy looking seeds. The maximum reduction in 1000 seed weights has been attributed to the badly deformed seeds with wrinkled seed coat. Seeds affected with M. phaseolina showed 15.5 per cent less seed weight of 1000 seeds when compared to similar number of seeds belonging to category I. Seeds belonging to category III were having 57 to 70 per cent seed germination.
Fungi causing disease to the plant parts of sesame are quite common in the country (Jain & Sukkarni, 1965; Mohanty, 1958; Mehta & Prasad, 1976). Surveys conducted in the eleven districts of Bundelkhand region to record the occurrence and distribution of the four major diseases like root rot, stem rot, leaf spot and capsule damage, revealed the presence of all the four diseases in these areas. Of these, leaf spots assumed a higher proportion. Root rot incidence was comparatively low than stem rot. It was least in Chhatarpur and Panna and maximum in Jhansi, Hamirpur, Damoh and Datia, while stem rot incidence was minimum in Jalitpur and Damoh and maximum in Hamirpur, Tikamgarh and Sagar.

Fungi associated with plant parts play an important role in the annual disease recurrence and spread. The role of soil borne fungi in causing the plant diseases has been enumerated by Park (1963) and epiphytic microorganisms by Leben (1965). Later, a number of pathogenic fungi associated with plant parts have been recorded (Ruscose, 1971; Mishra & Srivastava, 1971; Meena, 1971). The presence of *Phaselina* associated with leaves of sesame was, however, recorded recently by Sharma and
Nukerji (1974) present investigations showed the presence of *P. phaseolina* and *G. cassincola* on root, stem, leaf, pod and seed of *sesamum*. In addition, *A. alternata*, *A. sesami* and *Mycosphaerella roridum* rode ex pries were associated with leaf, fruit and seeds and *Cercospora sesami* with leaf only while *Phoma* sp. was found on the stem.

Isolation and maintenance of fungi were generally carried out on common culture media e.g., *Czapeck's* agar and PDA, or media containing anti-bacteria antibiotics and other non-selective inhibitors in early years (Littman, 1947; Martin, 1950). Later, Tsao, (1970) has reviewed several selected media for different fungi. The maintenance of the major fungi under reference was done on PDA. The consistency in growth and sporulation provided a satisfactory picture with regard to their morphological characteristics. The description of cultural characteristics of *A. sesami*, *G. cassincola*, and *P. phaseolina* generally agreed to the described characteristics (Subramaniam, 1971).

Uppal (1936) reported *Asthana* and *Hawker's* agar medium as best for the growth of *P. phaseolina* than to rice agar medium. Shanmugam and Govindasamy (1973) reported best growth of *P. phaseolina* on *Richard's* agar. Various
selected media for this fungus have been given by
Vaaartaja (1963) and Shen et al., (1966). The present
studies showed that Czapek's agar was superior for short
duration growth followed by Asthami and Hawker's agar.
However, the growth of the fungus was comparable to these
media along with PDA after five days. Richard's agar
was also found superior in the production of large
sclerotia. The size of sclerotia was found suppressed
in Sabouraud's agar and PCNB-PDA.

Pathogenicity of M. phaseolina, C. cassicola
and A. sesami was compared by seed infestation and soil
infestation technique. M. phaseolina was found more
pathogenic to the remaining fungi as the pre-emergence loss
caused by it through seed infestation and soil infestation
was 55 per cent and 40 per cent respectively. The post-
emergence loss was 30 per cent. A. sesami was responsible
to 25 per cent and 30 per cent pre-emergence loss in the
seed and soil infestations respectively. The post
emergence loss may be because of the toxic substances
secreted by the seed borne fungi (Yorgues, 1962; Spenceley,
1963 and Leesmore, 1964). The total mortality caused by
M. phaseolina was quite high. The possible cause for high
rate of pathogenicity of *M. phaseolina* can be due to the production of enzyme activity. The production of polygalacturonase has been demonstrated by Parasar and Suryanarayana (1971).

Several reports exist on the control of *M. phaseolina* by seed treatment and or soil drench (Das and Sengupta, 1963; Shukla and Singh, 1973; Tripathi et al., 1977; Lewin and Natarajan, 1971; Chakravarti et al., 1973). The effects of fungicides on *G. cassiicola* and *A. sesami* have also been studied (Singh et al., 1969; Abraham et al., 1976). The various fungicides tried in vitro could check the growth of *M. phaseolina* at higher concentrations.

At low concentrations of 0.25 per cent of Tridem, benlate and mercuric chloride inhibited completely the growth of the fungus. In vivo the infection by *M. phaseolina* was controlled by the application of Vitavax at the rate of 0.1 per cent, Demesan 0.1 per cent, Benlate 0.2 per cent, and Geresan wet 0.3 per cent, when studied in unsterilized soil. The fungicide Vitavax gave the similar result when applied in sterilized soil. The growth of *A. sesami* was inhibited by pitman G-78 at the rate of 0.2 per cent out of the twelve fungicides tested. Complete control of
G. cassicola was, however, offered by Captan at the rate of 0.2 per cent and ceresan et at the rate of 0.5 per cent. In case of M. phaseolina, Captan at the rate of 0.2 per cent showed complete growth inhibition. Other fungicides like Captan and Thiram applied as seed treatment, have been found to reduce post-emergence mortality under pot and field trials (Sinha and Khare, 1977).

The presence of abundant mycelia and pycnidia in all the parts of seed proved the seriousness of the pathogen in causing disease. The nature of mycelium spread as inter-cellular and intra-cellular substantiated the pathogenicity of the fungus. Similar behaviour of M. phaseolina has been observed in 'Rajma' (Phaseolus vulgaris Linn.) by Agarwal and Jain (1978). Various stages of development of pycnidia of M. phaseolina were observed on the surface of cotyledons as well.

Fungi pose a serious problem in seed storage. Seed deterioration by fungi in storage has received considerable attention (Goodman and Christensen, 1952; Quasem and Christensen, 1960; Lalithakumari et al., 1971;
The field fungi that are carried through seeds may live for years in stored grains (Christensen, 1963). The succession in fungi prevalence under normal storage conditions of food and feed grains have been worked out (Christensen and Lopez, 1963; del Prado and Christensen, 1952; Tuite and Caristensen, 1955). Under present investigations normal seed storage condition was provided to sesame seeds in different containers. All the three fungi under reference, viz; _M. phascolina_, _C. cassiicola_ and _A. sesami_ were recovered after one year of storage. However, the association percentage of the seed mycoflora showed a gradual decline. It was also found that cloth bags with polythene lining as well as cloth bags were highly suitable for the storage of sesame seeds.