DISCUSSION

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Gerbera (*Gerbera jamesonii)* H.Bolux ex J.D.Hook is an important commercial flower crop and is grown throughout the globe. It is the 5th most used cut flower in the world. The flowers of these plants are mostly used in arrangement of cut flowers because of its size and the wide variety of colours that are available. The cut blooms when placed in water remain fresh for longer time. It is very attractive plant with flowers having different colours. The flowers are used in festivals, parties and wedding ceremonies etc. It is native of South Africa.

Such a beautiful plant is attacked by many fungal diseases. Out of these leaf spot of Gerbera caused by *Alternaria alternata* is very serious. The infected plants show low vitality, suppressed development, smaller distorted flowers. Therefore, in the present investigation efforts were made to manage the leaf spot of Gerbera by following at most scientific methodologies.

In the present investigation MIC of carbendazim against *Alternaria alternata* ranged from 10 to 15% on agar plates and 5 to8% on Gerbera plants. These results are in agreements with other workers also. According to Mane (2009) the MIC of carbendazim against *Alternaria tenuissima* causing leaf spot of taro was ranging from 4 to 8.5% *in vitro* and 100µg/ml *in vitro* and 0.5 to 25 µg/ml *in vitro*

MIC of Redomil against *Phytophthora palmivora* var. *Piperina* was ranging from 2500 µg/ml to 4600µg/ml *in vitro* and 2000 to 3000µg/ml *in vivo* Patil (2009). Similarly More (2009) reported the MIC of tilt against *Phakopsora pachyrhizi* ranged from 3µg/ml to36 µg/ml. According to Kamble (1999) MIC of carbendazim against *Macrophomina*

phaseolina causing charcoal rot of potato ranged from 110 µg /ml to 1000 µg/ml *in vitro* and 90 µg/ml to 100 µg/ml *in vivo*.

Annamalai and Lalitkumar (1990) stated that it is necessary to determine the baseline sensitivity for the fungicide against a sensitive strain. Therefore the sensitivity of four isolates of *Alternaria alternata* causing leaf spot of Gerbera was determined. Bruin (1982) suggested that heterogeneous population of nuclei consisting of sensitive and resistant nuclei in the isolates might be responsible for variation in the MIC of fungicide. There are many workers who reported similar findings (Jones and Ehert,1976 ;Dekker and Gielink,1979;Gangawane and Shaikh .1988;Whaghmare,1990;Kamble,1993;Khailare.1997;Bhale.2002;ssBharade,2002; Wadikar,2002 ;Hiwale,2003;Telmore,2004 and Apte,2008)

Fungicide a spray programme may be responsible for the development of fungicide resistance in pathogens. Therefore, effect of continuous alternate and in mixture of two different fungicide on the development of fungicide resistance for eight successive passages was carried out. It is seen that there was increase carbendazim resistance in the sensitive isolate when cultured continuously on carbendazim for eight successive passages. But when the pathogen was cultured alternately with mancozeb, kocide-101 and roko the growth of pathogen was completely checked at 2nd passage only in case of carbendazim alternating with mancozeb and kocide-101. In case of carbendazim alternating with roko the same results was obtained at 4th passage.

Use of carbendazim in mixture with mancozeb, kocide-101 and roko gave very good results, the pathogen failed to grow in the 1st passage itself, suggesting reduction in fungicide resistance. More or less similar results were there when the experiments were carried out on Gerbera plants. According to Horsten (1979) *Septoria*

nodorum the incitant of culm bloch of Wheat was able to develop maximum resistance to carbendazim both on agar plates and on Wheat plant. Griffin (1981) advised the alternate use of different fungicides to reduce the problem of fungicide resistance in fungal pathogen. Horsten (1979) also noticed that use of ediphenphos with carbendazim reduced carbendazim resistance in *Septoria nodorum* and *Cercosporella herpotrichoids*. Hartill (1983) stated that alternate use of metaxyl with Mancozeb reduces metalxyl resistance in *Phytopthora infestans* causing late blight of potato. Use of carbendazim alternately with Zineb and Kocide -101 reduced the carbendazim resistance significantly (Mane,2009) she further reported that carbendazim in mixture with Mancozeb, Zineb and Kocide 101 completely inhibited the growth of *Alternaria tenuissima*, causing leaf spot of taro.

Use of fungicides in combination with other fungicides reduced carbendazim resistance. More (2009) found that use of tilt in mixture with contaf and byleton prevented the infection of *Phakaopsora pachyrhizi* to soybean. Carbendazim in mixture with mancozeb zineb completely checked the growth of *Macrophomina phaseolina*, causing charcoal rot of potato; at the first passage only (Kamble and Gangawane, 1999). Carbendazim in combination with benomyl completely inhibited the growth of *Sclerotium rolfsii,* causing fruit rot of cucumber.(Hiwale,2003)

Agrochemicals such as fungicides, insecticides, antibiotics, herbicides, salts and fertilizers are used in crop management. Therefore, there is possibility that these chemicals may increase or decrease development of fungicide resistance in pathogen. Many of agrochemical may break the fungicide resistance or *vice versa*, when used in mixture. In the present investigation it was observed that carbendenzim in combination

with fungicides (kavach, mancozeb and ridomil), herbicide (Mera-71) *in vitro* completely inhibited the growth of *Alternaria alternata.*

In *in vivo* studies it was seen that carbendazim with fungicides (kavach, mancozeb and ridomil), insecticides(thimate) gave cent percent control of infection of *Alternaria alternata* to gerbera plant. The above mentioned agrochemical gave hundred percent control efficacy with carbendazim. These results are similar with other workers. Dekker (1981), advised that use of fungicides in combination with other agrochemicals to avoid the problem of fungicide resistance. He stated that with the combination of two specific site inhibitors the possibility exists that the pathogen will not acquire resistance to both the chemicals. Mixture of metalxyl with mancozeb was very useful in controlling foliar diseases of crops caused by oomyceteous fungi. benomyl with capton, chlorothalonil and imazalil lowered benomyl resistance in *Venturia inaequalis* causing apple scab (Shabi and Gilpatrick, 1981). Dekker(1981) agrued that there is significant delay in emergence of fungicide resistance in fungal pathogens in field due to the use of mixture of fungicides. Fungicides and antibiotics used in mixture have different mode of action on the pathogen applied, therefore, the control of resistance became easier (Griffin, 1981) .Acibenzolar-s-methyl with fungicide and antibiotics gave positive results in controlling coffee rust and leaf spot(Patricio et al;2008)

According to Mane(2009) carbendazim in combination with contaf, monasaan and thimate completely inhibited the growth of *Alternaria tanuissima* causing leaf spot of taro.Carbendazim with capton, zineb, mancozeb, methomyl ,endosulphan monocrotophos, 2,4 –D, excel, mera-71 ,zepclav 500,griseofulvin,oflaxcin 400 potassium choride, sodium chloride, calcium chloride, manganese chloride, urea muriate of potash 10:26:26, 5:10:5 mixture of urea ,super phosphate, sufla,nimboli,potash,iron,

molybdenum ,cobalt, copper and manganese completely inhibited the growth of *Macrophomine phaseolina* causing charcoal rot of sweet potato(Patil.2009). similarly More (2009) found that tilt with mancozeb, zineb captan ,roko, thimate , endosulphan, streptomycin and aureofungin completely checked the infection of *Phakopsora pachyrhizi* to soybean plants.