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ANTIMICROBIAL ACTIVITY OF THE ESSENTIAL OILS OF THE UMBELLIFERAE FAMILY

Part V. *Carum carvi, Petroselinum crispum* and *Dorema ammoniacum* Oils

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The entimicrobial activity of the essential oils of *Carum carvi, Petroselinum crispum* and *Dorema ammoniacum* has been studied spectrophotometrically in emulaified broth against the standard strains of Staphaureus, *E.coli, S.typhi, S. dysentery* and *V.cholera.* Optical density was taken as the index of bacterial growth. All oils showed good inhibitory activity against all five pathogens.

Key words: Carum carvi, Petroselinum crispum, Dorema ammoniacum.

INTRODUCTION

Oils of different species of N.O. Umbelliferae are being studied in these Laboratories for their biological activity. Results of some of the oils have already been reported [1]. The antimicrobial activity of *Carum carvi* (caraway), *Petroselinum crispum* (parsley), and *Dorema ammoniacum* "ushak", have now been studied and are being reported in the present communication. The physico-chemical properties of these oils have already been reported [2].

The inhibitory activity of *C. carvi* oil against some bacteria, when tested by the agar diffusion method, indicated that it was dose dependant [3,4], and affected the growth of many gram positive and gram negative bacteria [5] and fungi [6]. The activity of caraway oil as a whole was found to be more than those of the individual components [4]. The oil, because of its antiinflamatory, healing and toning effects, was recommended for use in soaps having dermatological properties [7] as well as in medicines [8-12]. Oil of caraway when compared with eugenol for its activity against micro-orgamisms implicated in the production of dental caries was found to be equally effective and showed less hemolytic and toxic qualities [13].

Another medicinally important plant of N.O. Umbelliferae is *Petroselinum crispum* or parsley. Besides being spasmolytic and diuretic [14], the oil also possesses antibacterial characteristics [15]. These characteristics may be due to its coumarin [16] and bergapten [17] contents.

Dorema ammoniacum or "ushak" is also therapeutically important and has also been recommended for use in medicine [10].

Though some of its oils have previously been studied randomly along with some members of different families by simple agar diffusion method, the antimicrobial activity of Umbelliferae family as such has not been studied. As essential oils tend to evaporate at the prevailing experimental conditions of this method, the reported results are aften non-repeatable and misleading. Therefore, we have studied the oils of these species in emulsified broth against the pure cultures of *Staphylococcus aureus, Escherichia coli, Salmonella typhi, Shigella dysentery* and *Vibrio cholera.*

MATERIAL AND METHOD

Material

1. *Cultures:* The pure cultures of *Staphylococcus aureus* 6538-P *Escherichia coli* M/200, *Salmonella typhi, Shigella dysentery* and *Vibrio cholera* were provided through the good offices the National Institute of Health Islamabad, and the Drug Testing Laboratories, Lahore.

2. *Media:* Merck's agar meduim for stock culture slants and Oxoid Antibiotic Medium No. 3 for liquid broth were used.

3. *Essential oils:* The essential oils were obtained by the steam distillation of the seeds of *Carum carvi, Petroselinum crispum* and *Dorema ammoniacum.*

Preparation of media and inoculum. The media and inoculum were prepared according to the method already reported [1]. After incubation of the tubes at 35° for 20 hr the absorbance was measured at 530 nm on Hitachi Model 100-20 UV-Vis spectrophotometer. The optical density taken as an index of bacterial growth was plotted against the quantity of essential oil in ppm.

RESULTS AND DISCUSSION

Tables 1-5 and Fig. 1-5 show the means of optical density against the quantity of essential oil used in ppm. The concentration of oil which causes an eightfold inhibition of growth is taken as its Minimum Inhibitory Concentration (MIC). Bacteriawise results are presented below.

Table 1. Antimicrobial activity against *Staph. aureus.*

Amount of essential oil (ppm)	Optical density (mean)		
	C.carvi	*P.crispum*	*D.ammoniacum*
0	449	428	410
400	215	335	288
800	12	296	180
1200	0	220	41
1600	0	164	0
2000	0	164	0
2400	0	102	0

Table 2. Antimicrobial activity against *E. coli*

Amount of essential oil (ppm)	Optical density (mean)		
	C.carvi	*P.crispum*	*D.ammoniacum*
0	436	412	400
400	356	339	318
800	294	260	240
1200	290	249	201
1600	250	217	122
2000	180	261	92
2400	152	160	78

Table 3. Antimicrobial activity against *S.typhi*

Amount of essential Oil (ppm)	Optical density (mean)		
	C.carvi	*P.crispum*	*D.ammoniacum*
0	465	421	401
400	225	384	289
800	78	332	170
1200	19	268	104
1600	16	83	33
2000	11	28	15
2400	11	0	0

1. *Staphylococcus aureus.* The oil of *C. carvi* has promising activity against *Staph-aureus* (Fig 1, Table 1). The activity resembles that of *Foeniculum vulgare* [1] and *Anethum graveolens* [18]. Its MIC was found to be 700 ppm. The oil of *P. crispum* shows very effective inhibitory activity against this organism but is less than that of caraway and better than that of *Ferula ovina* [19]. Its MIC was about 1100 ppm. *D. ammoniacum* shows a dose dependent inhibition against this bacterium. The linear graph of inhibition resembles with that of *Ferula oopoda* [19]. Its activity is less than *P. crispum.*

2. *Escherichia colis. E.coli is a resistant bacterium.* All the three species show similar graphs of inhibitory activity (Fig 2, Table 2) whereas the activity of *D. ammoniacum* is more than that of the other two species and is somewhat like the activity of *Pimpinella anisum* [20]. The inhibition by *C. carvi* and *P. crispum,* of *E. coli* seems to be effective but somewhat delayed.

3. *Salmonella typhi.* The activity of *C. carvi* against *S.typhi* increases rapidly with increase in the amount of the oil (Fig 3, Table 3). A twofold inhibition has been

Table 4. Antimicrobial activity against *S.dysentery*

Amount of essential oil (ppm)	Optical density (mean)		
	C.carvi	*P.crispum*	*D.ammoniacum*
0	625	652	598
400	439	613	529
800	308	508	197
1200	38	408	84
1600	19	257	68
2000	18	101	54
2400	9	48	42

Table 5. Antimicrobial activity against *V.cholera*

Amount of essential oil (ppm)	Optical density (mean)		
	C.carvi	*P.crispum*	*D.ammoniacum*
0	958	988	937
400	659	875	781
800	451	826	714
1200	356	720	689
1600	301	615	647
2000	256	589	592
2400	227	566	526

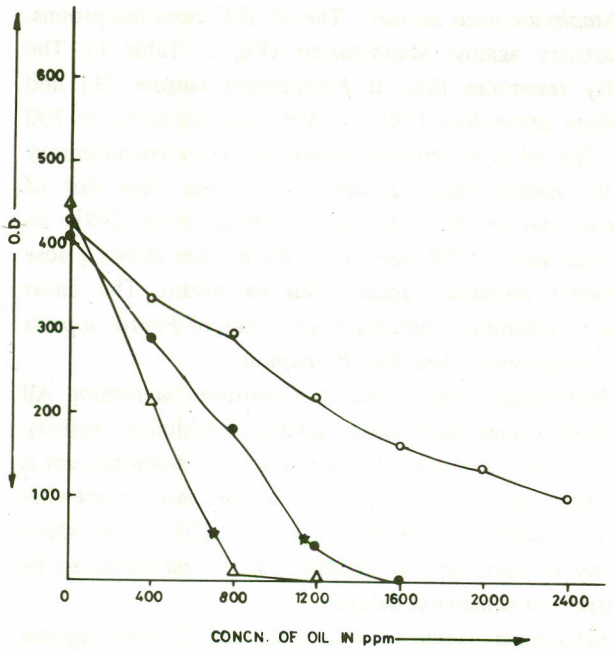

Fig. 1 Activity of - △ -*Carum carvi*; - ○ - *Petroselinum crispum*; ● -*Dorema ammoniacum* against *Staphylo-coccus aureus*, ★MIC.

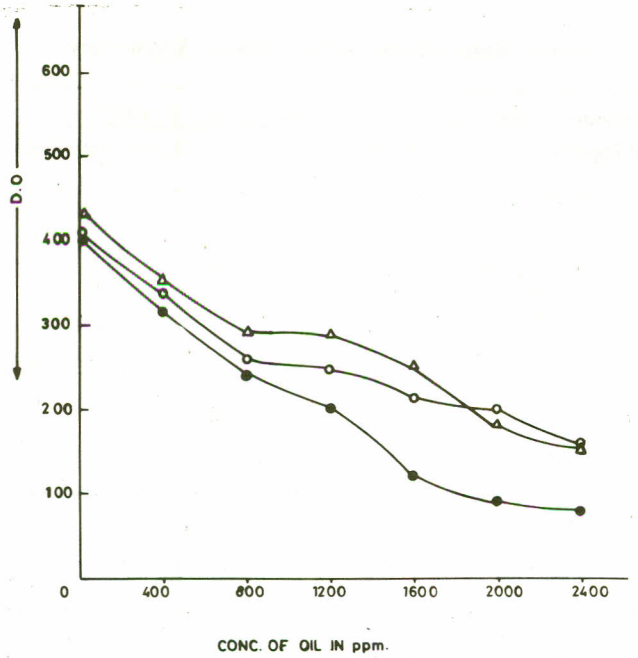

Fig. 2 Activity of - △ -*Carum carvi*; - ○ - *Petroselinum crispum*; - ● - *Dorema ammoniacum* aginst *Escherichia coli*, ★MIC.

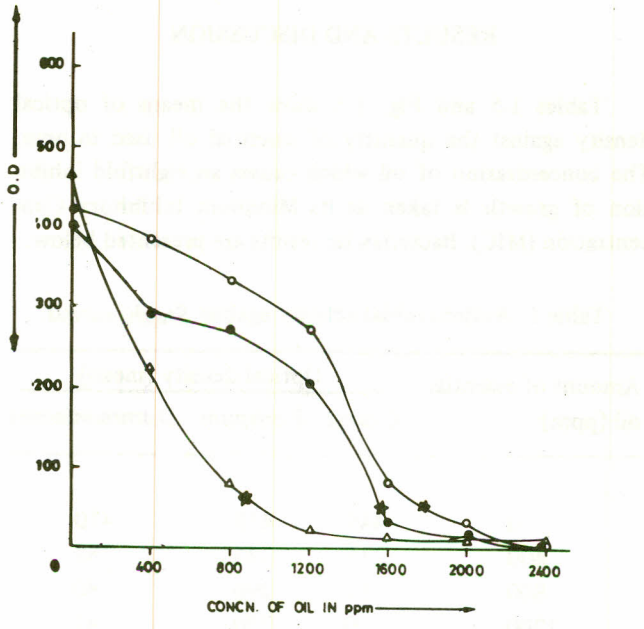

Fig. 3 Activity of - △ -*Carum carvi*; - ○ -*Petroselinum crispum*; - ● - *Dorema ammoniacum* against *Salmonella typhi*, ★MIC.

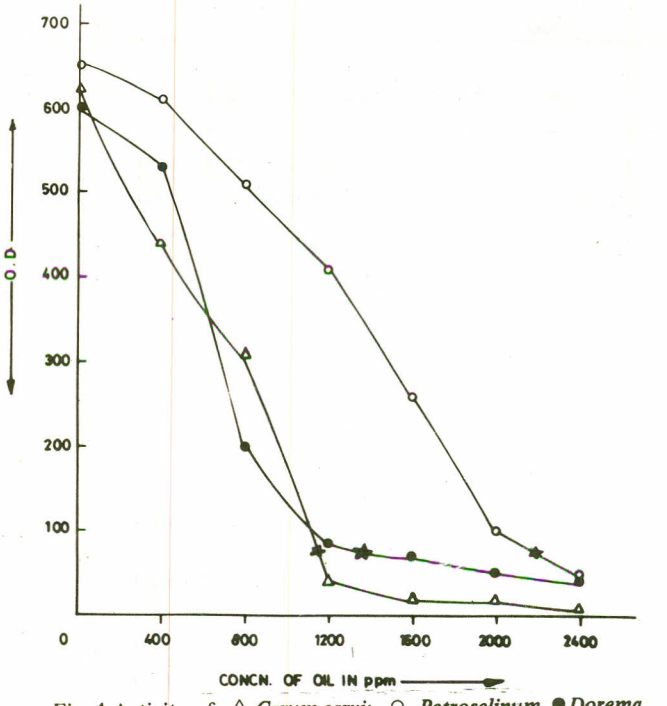

Fig. 4 Activity of - △ -*Carum carvi*; - ○ - *Petroselinum*. ● *Dorema ammoniacum* against *Shigella dysentry*; ★ MIC.

observed at 400 ppm and the MIC level reaches at less than 900 ppm. Bacteriostatic effect is observed after 1200 ppm. The activity of this oil resembles that of *P. anisum* [20] but is less than that of *Cuminum cyminum, Coriandrum sativum,* and *Bunium persicum* [1]. Both oils of P. crispum *and* D. ammoniacum show identical type of inhibitory graph but the activity of *P. crispum* is better. The MIC level for *P. crispum* is less than 1600 ppm, and for *D. ammoniacum* is less than 1800 ppm. The activity of both these oils is better than *Trachyspermum ammi* [18], *Pimpinella acuminata, Pimpinella stewartii* [20], and *F.oopoda* [19], but is less than that of *C.cyminum, C.sativum, F.vulgare* and *C.carvi* The MIC level for *P. crispum* is less than 1800 ppm. and for *D. ammoniacum* is less than 1600 ppm.

4. *Shigella dysentery*. Of all the three essential oils,

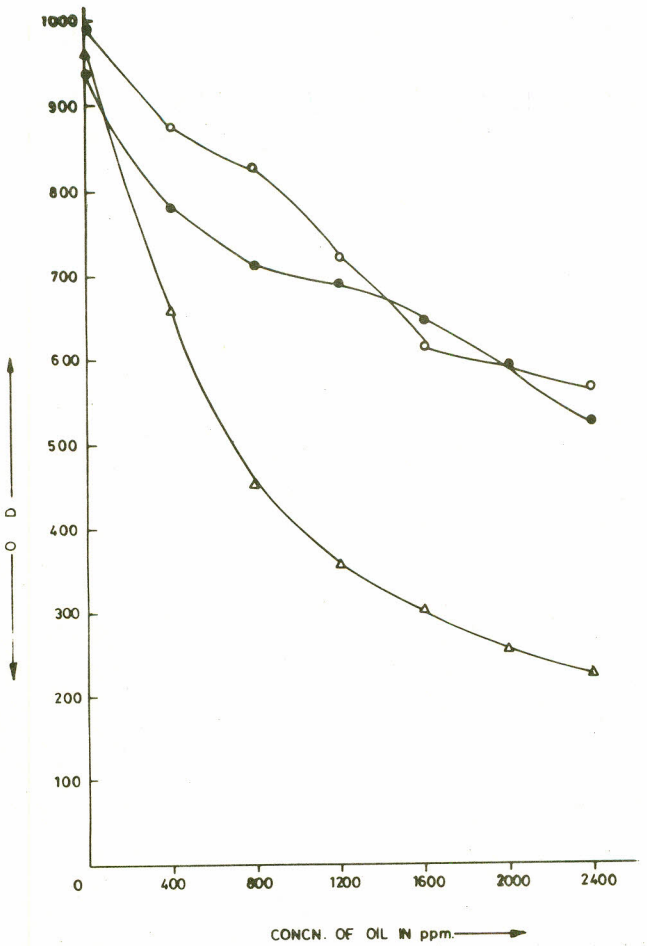

Fig. 5 Activity of -△- *Carum carvi*; - ○ - *Petroselinum crispum*; 6- ● - *Dorema ammoniacum*; against *vibrio cholera* ★MIC.

C.carvi is best in activity against the pathogen of dysentry. (Fig. 4 Table 4). A twofold inhibition has been observed at 800 ppm, and the MIC level is less than 1200 ppm. However the activity is still lesser than *T.ammi[18] and F.vulgare* [1]. *P.crispum* shows a rapid linear graph of inhibition against this organism. The inhibition of growth becomes twofold at 1400 ppm. It is more active than *Daucus carota* [18]. *Ferula narthex* [19] and *P. acuminata* [20], but it is less active than *C.cyminium and* B. perisicum [1].

The activity of *D. ammoniacum* is better than that of *P.crispum.* A twofold inhibition has been observed at 650 ppm and MIC level reaches before, 1400 ppm. The rate of inhibition resembles that of *B.persicum* [1].

5. *Vibrio cholers.* The activity of *C.carvi* initially resembles that of *P.anisum* [20], but at higher doses the activity of *P.anisum* is greater. However at 800 ppm., *C.carvi* causes a twofold inhibition of this organism (Fig. 5, Table 5). About fourfold inhibition has been observed at 2400 ppm. Both *P.crispum* and D. ammoniacum are moderate in activity. The activity is far less than that of *C. carvi,* but is still greater than that of *F. narthex* and *F.ovina* [19] and is somewhat like that of *D.carota* [18]. However the activity of *D. ammoniacum* is better than that of *P. crispum.*

The overall activity of all the three oils is good against all gram positive and gram negative bacteria. They can be recommended for use as therapeutic agents in or beside the existing antibiotics.

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