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ANTIMICROBIAL ACTIVITY OF THE ESSENTIAL OILS OF UMBELLIFERAE FAMILY

Part VIII. Seseli libanotis, Ligusticum Stewartii and *Pycnocycla aucheriana* Oils

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The essential oils of the seeds of *Seseli libanotis, Ligusticum stewartii* and *Pycnocycla aucheriana* have been tested against the pathogenic bacteria of *Staphyococcus aureus, Escherichia coli, Shigella dysentry,* and *Vibrio cholera.* The tests were carried on in emulsified broth using spectrophotometric method. Of the oils tested, *Sesali libanotis* is most effective, especially against *Staph. aureus.* While at higher doses, the oil of *P. aucheriana* was also effective against pathogen like *S. typhi.*

Key words: *Seseli libanotis, Ligusticum stewartii,* and *Pycnocycla aucheriana.*

INTRODUCTION

Umbellifers have a well recognized place in Hikmet, Tibbi and local remedies, throughout the world. *Seseli* is a genus of this family with 80 species distributed in Europe and Asia. The species *Seseli libanotis* (Chots eachga) grows wild in Pakistan (in Gilgit, Chitral, Ziarat, Kaghan and Swat). Its seeds have been used in local remedies for blood pressure control. The main constituents of pleasant smelling essential oil are, limonene, β-phellandrene, myrcene, pinene and 16-20% coumarins [1].

Ligusticum is a genus of 60 species grown in North temperate regions. Some species of this genus are known to be effective in cardiac diseases [2]. The species *Ligusticum stewartii* (Burha-eachga) grows wild in N.W.F.P. Alcohols and acids (48%), terpenes (30%), and coumarins with tarry material (17%) are the main constituents of this oil [3].

The genus *Pycnocycle* includes some 10 species. The species *Pycnocycla aucheriana* (Bibi buto) is a wild species endemic to Baluchistan region. Linalool constitutes the major portion of this oil [4].

The above mentioned species were tested against some pathogenic bacteria in continuation of our work on the antibacterial effect of essential oils specifically from the Umbelliferae family [5].

MATERIAL AND METHOD

1. *Cultures.* The standard cultures of *Stephylococcus aureus* ATCC-6538-P., *Escherichia coli* M/200, *Salmonella typhi, Shigella dysentry,* and *Vibrio cholera* were kindly provided from the National Institute of Health, Islamabad, and the Drug Testing Laboratories, Lahore.

2. *Media.* For the stock-culture-slants, Merck's medium was used, while for antibacterial assays, the oxoid antibiotic medium No. 3 was utilized.

3. *Essential oils.* The essential oils were obtained from the seeds of *Seseli libanotis, Ligusticum stewartii,* and *Pycnocycla aucheriana* by steam distillation.

Preparation of media and inoculum. The media and inoculum were prepared using the methods described earlier [5]. The tubes were incubated at 35° for 20 hrs, and the optical density taken as index of bacterial growth, was measured spectrophotometrically, using Hitachi Model 100-200 UV-Vis spectrophotometer. The rate of growth was plotted against the quantity of essential oils in parts per million (ppm).

The bacteria wise results of the essential oils are reported herein.

DISCUSSION

1. *Staphylococcus aureus.* The essential oil of the seeds of *Seseli libanotis* at 400 ppm causes about 74% inhibition of *Staph. aureus.* which increases upto 94% at 800 ppm. The oil, at 1200 ppm causes 100% inhibition. The minimum inhibitory concentration (MIC) is found to be 600 ppm. The inhibitory effect of *S. libanotis* resembles with the activity of *Anethum graveolens* against *Staph aureus.*

The essential oil of the seeds of *L. stewartii* is not so effective against this organism. The effect however is more

Table 1. The activity of essential oils against *Staphylococcus aureus.*

Amt. of oil in ppm.	Optical density (mean). *Seseli libanotis*	*Ligusticum stewartii*	*Pycnocycla aucheriana*
0	445	459	421
400	118	325	410
800	28	268	377
1200	0	248	349
1600	0	208	310
2000	0	204	158
2400	0	112	86

than *Ferula copode* [3]. The oil at 400 ppm causes just 30% inhibition of *S. aureus*. The inhibition slowly rises to 56% at 2000 ppm concentration of oil. However at 2400 ppm the inhibition rises upto 76%.

The oil of *P. aucheriana* at initial concentration is even slower in its activity against this organism. Only 15% inhibition of the organism is observed at 400 ppm., which increases to 57% at 1200 ppm. At 1600 ppm., the inhibition becomes 70% and rises upto 80% at the maximum dose of 2400 ppm.

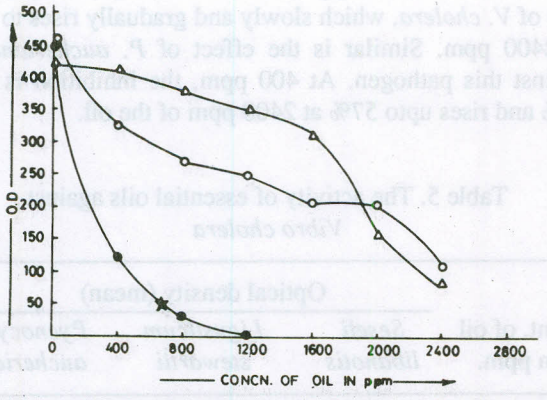

Fig. 1. Activity against *Staphylococcus aureus* of –•– Seseli libanotis; –o– Ligusticum stewartii; –Δ– Pycnocycla aucheriana, * mic.

2. *Escherichia coli*. The oil of *S. libanotis* causes about 36% inhibition of *E. coli* at 400 ppm. which increases upto 60% at 800 ppm, while 1200 ppm. is it's MIC. The activity then gradually rises upto 93% at 2400 ppm. The effect is very much similar to that of *Ferula ovina* [7].

The oil of *L. stewartii* is quite slow in activity at the initial doses, however 64% inhibition is caused by 1200 ppm, which gradually rises to 75% at the dose of 2400 ppm. The activity is somewhat like that of *Dorema ammoniacum* oil [8].

The activity of the oil of *P. aucheriana* against *E. coli* is slightly better than *L. stewartii*. At initial concentration of 400 ppm, the inhibition is 37% which gradually increases to 58% at 1600 ppm. At 2000 ppm, the inhibition is 73% and at 2400 ppm, it is 87%.

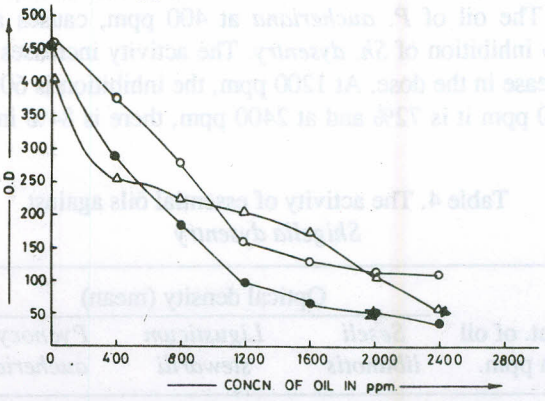

Fig. 2. Activiti against *Escherichia coli* of –•– Seseli libanotis; –o– Ligusticum stewartii, –Δ– Pycnocycla aucheriana; * mic.

3. *Salamonella typhi*. At 400 ppm, the essential oil of the seeds of *S. libanotis* causes 60% inhibition of *S. typhi*. The MIC is about 1000 ppm. The activity rises further with increase in the dose and at 2400 ppm, the inhibition of this organism is 93%. Against this pathogen the oil is more active than *Daucus carota* [6].

The oil of *L. stewartii* is less active against this pathogen. At 400 ppm the inhibition is 43% which increases to 70% at 1200 ppm. The activity then becomes almost static and at 2400 ppm the inhibition becomes 74%.

The oil of *P. aucheriana* at initial dose shows only 13% inhibition. At 1200 ppm, the inhibition becomes 77%. The MIC is about 1300 ppm. At 1600 ppm the inhibition rises upto 90% and becomes almost 100% at the maximum dose of 2400 ppm. The oil at higher doses is more active than the oil of *Stewartiella baluchistanica* [9].

4. *Shigella dysentry*. The oil of *S. libanotis* causes only 20% inhibition of *Sh. dysentry* bacteria. At 800 ppm, the inhibition becomes 43%, at 1200 ppm, the inhibition is 62% and rises upto 85% at 2400 ppm. The MIC is about 2200 ppm.

At initial concentration of 400 ppm, the oil of *L. stewartii* has virtually no effect against this organism. At the

Table 2. The activity of essential oils against *Escherichia coli.*

Amt. of oil in ppm.	Optical density (mean)		
	Seseli libanotis	*Ligusticum stewartii*	*Pycnocycla aucheriana*
0	453	452	400
400	291	376	253
800	185	280	223
1200	97	162	202
1600	64	132	169
2000	50	117	109
2400	34	113	54

Table 3. The activity of essential oils against *Salmonella typhi*

Amt. of oil in ppm.	Optical density (mean)		
	Seseli libanotis	*Ligusticum stewartii*	*Pycnocycla aucheriana*
0	461	462	412
400	186	262	360
800	97	169	258
1200	72	136	96
1600	53	126	44
2000	44	122	21
2400	39	121	3

maximum dose of 2400 ppm, there is just 27% inhibition of this pathogen.

The oil of *P. aucheriana* at 400 ppm, causes about 36% inhibition of *Sh. dysentry*. The activity increases with increase in the dose. At 1200 ppm, the inhibition is 60%, at 2000 ppm it is 72% and at 2400 ppm, there is 84% inhibition of this organism. This effect resembles with that of *S. libanotis* against this pathogen.

5. *Vibrio cholera*. At 400 ppm, there is only 13% inhibition of the pathogenic bacteria of *V. cholera* by the oil of *S. libanotis*. It slowly increases to 36% at 1200 ppm, but at 1600 ppm it suddenly rises upto 73% and then remains static even at higher doses.

The oil of *L. stewartii* at initial doses has similar effect but the inhibitory effect does not increase much at higher doses as well. At 400 ppm, the oil causes just 18% inhibition of *V. cholera*, which slowly and gradually rises to 50% at 2400 ppm. Similar is the effect of *P. aucheriana* oil against this pathogen. At 400 ppm, the inhibition is only 10% and rises upto 57% at 2400 ppm of the oil.

Table 4. The activity of essential oils against *Shigella dysentry*

Amt. of oil in ppm.	Optical density (mean)		
	Seseli libanotis	*Ligusticum stewartii*	*Pycnocycla aucheriana*
0	578	524	665
400	467	478	428
800	331	403	384
1200	225	390	306
1600	179	368	260
2000	126	336	189
2400	89	310	111

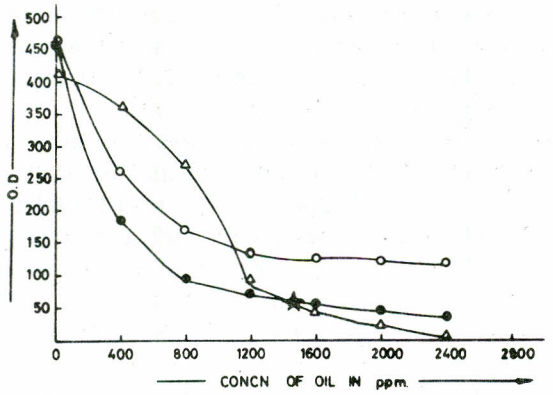

Fig. 3 . Activity against *Salmonella typhi* of –•– Seseli libanotis; –o– Ligusticum stewartii; –Δ– Pycnocycla aucheriana; * mic.

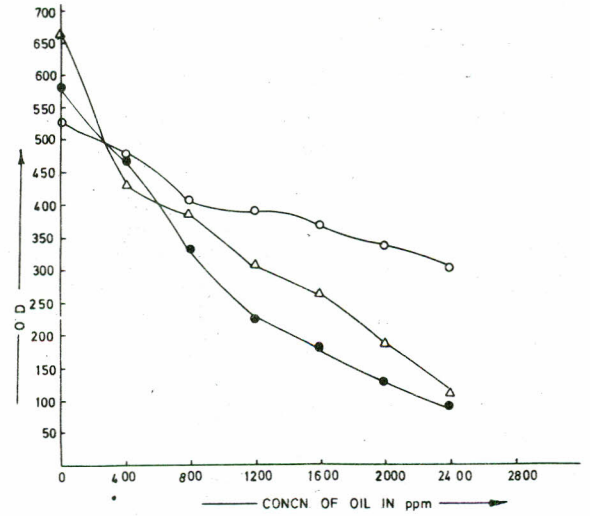

Fig. 4. Activity against *Shigella dysentry* of –•– Seseli libanotics; –o– Ligusticum stewartii; –Δ– Pycnocycla aucheriana; * mic.

Table 5. The activity of essential oils against *Vibro cholera*

Amt. of oil in ppm.	Optical density (mean)		
	Seseli libanotis	*Ligusticum stewartii*	*Pycnocycla aucheriana*
0	928	921	910
400	810	754	815
800	641	728	740
1200	561	689	622
1600	258	660	541
2000	258	538	460
2400	258	464	395

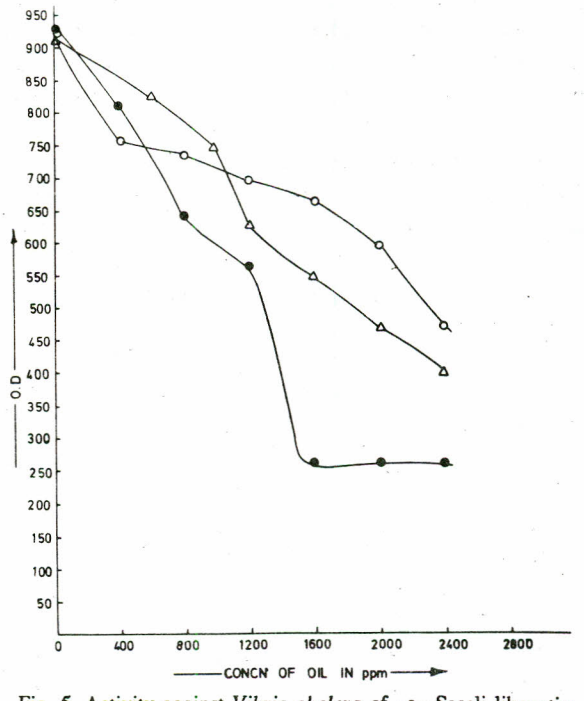

Fig. 5. Activity against *Vibrio cholera* of –•– Seseli libanotic; –o– Ligusticum stewartii; –Δ– Pycnocycla aucheriana; * mic.

Of the three oils tested *S. libanotis* is most effective, especially against *Staph. aureus*. While at higher doses, the oil of *P. aucheriana* is also very effective against *S. typhi*.

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