Egypt. J. Microbiol. **38**, No. 1, pp. 105 -114 (2003)

Study of Antimicrobial Potencies of Some Yemeni Medicinal Plants.

M.R.Metwali

Botany Department, Faculty of Science, Benha, Zagazig University, Egypt.

TWENTY two medicinal plants were collected from Taiz city and its surroundings , Yemen Republic . Extracts of these plants were extracted and tested for their antimicrobial potency against three bacterial and two yeasts genera . It was found that most of the plant extracts showed marked activity against tested microorganisms especially yeasts, where by the data obtained revealed that all tested plant extracts were found to possess inhibitory effect on *Candida albicans and Saccharomyces cerevisiae*. Otherwise, it was found that 18% , 41% and 23% of the total tested plants have no effect on the isolates, *Staphylococcus aureus, E.coli* and *Pseudomonas aeruginosa,* respectively. The most effective tested medicinal plants were: *Tamarindus indica, Thymus vulgaris, Salvadora persica* (dry leaves), *Zizyphus jujuba, Lawsonia inermis, Hibiscus sabdariffa* and *Catha edulis* .

It is only if the medicinal plant has an acceptable safety index, it would be necessary to conduct detailed pharmacological / biochemical studies .

Key words : Plant antimicrobiol agents, *Tamarindus indica, Thymus vulgaris, Salvadora persica, Zizyhus Jujuba, Lawsonia inermis, Hibisus sobdariffa, Catha edulis* .

The plant kingdom contains a lot of medicinal plants which are known since ancient times and used as drugs for treatment of many diseases .

The suggested number of plants which are used as folk medicine amounts to about 25000 to 75000 species, but only 1% of these plants was seen to provide therapeutic benefit (Farnsworth, 1984) .

Plant have provided a good source of antiinfective agents. Thus emetine , quinine and berberine remain highly effective instruments in the fight against microbial infections (Iwu *et al.,* 1999) . Phytomedicines derived from plants have shown great promise for treatment of intractable infectious diseases including opportunistic AIDS infections (Fauci, 1998). Plants containing protoberberines and related alkaloids , picralima - type indole alkaloids and garcinia biflavonones used in traditional African and Asian systems of medicine have been found to be active against a wide variety of microorganisms (Boakye *et al.,* 1977; Sanaa and Zeinab , 1995 and Iwu *et al* . , 1999). Plants based antimicrobials have enormous therapeutic potential. They are effective in the treatment of infections diseases while simultaneously missing many of the side effects that are often associated with synthetic antimicrobials .

The country of Yemen is very rich in medicinal plants which are distributed in large areas (deserts, vallies, tops of mountains and also in agricultural fields). Some of these plants are seasonal which grow during rainfall period and disappear on dryness and the other medicinal plants are shrubs and trees (Bazeeb,1993; Scholte & Al khulaidi,1989; Al khulaidi, 1989 and Chaudhary & Reveri, 1983) .

The main aim of the present work is to screen the medical value of a taxon growing in the wild or planted, noted for its curing properties for antimicrobial activity.

Material and Methods

Plant collection

Collections were made from Taiz city and its surroundings, Yemen Republic. Table 1 contains the list the of tested plants.

Preparation of extracts

It was carried out following the methods described by Penelope (1999) .

a.Soaking method

Ten grams of the dried or 25 grams from the fresh plant materials were homogenized with 100 ml of sterile distilled heat water, then left for 10 min. filtered throughly Whatman No. I filter paper then through 0.45 Millepore filter and the filterate was stored at 4°C for further experiments.

TABLE 1. List of tested plants screened for antimicrobial activity .

Name of plant and family	Plant part used	Active constituents	Method of extraction
Allium cepa L. (Liliaceae)	Leaves	Glycokinin, antibacterial substances (e.g. scordinin A and phytonicidin), alliin and quercitin.	A
Allium sativum L. (Liliaceae)	Lobes	The same constituents of onion + allisin, iodine, L. cystcine, salycilic acid and volatile oils.	A
Citrus sinensis L. Osbeck (*Rutaceae*)	Peels	Volatile oils (0.5% consists of . citrol, citronellal, gerenyl acetate, terpinol and hysperidin.	A
Capsicum annum L. (Solanaceae)	Fruits	Alkaloids, volatile oils and vitamin C.	B
Catha edulis. Forssk. (Celastraceae)	Fresh leaves	Alkaloids, tannins and cathidiolines.	B
Cuminum cyminum L. (Umbelliferae)	Fruits	Volatile oils (cuminol and cuminic aldehiyde, 30-35%).	A
Eucalyptus comaldulensis Behnh. (Myrtaceae)	Fresh leaves	Eucalyptus oil consists of 80% ceneole.	A
Foeniculum vulgare Mill. (Umbelliferae)	Leaves	Volatile oils (anethole 60% and fenchone 20%)	A
Foeniculum vulgare Mill. (Umbelliferae)	Seeds	The same constituents of *Foeniculum vulgare*.	A
Hibiscus sabdariffa L. (Malvaceae)	Flowers	Volatile oils (Vitamin C and glycosides namely hibicin hydrochloride	A
Lawsonia inermis L. (Lythraceae)	Leaves	Lawsone (coloured substance), Tannins and volatile oil (and B-ionone).	C
Mentha piperita L. (Lamiaceae)	Leaves	Volatile oil (1-2.5%) mainly menthol (50-78%), cineol, menthone, phelandrene and cadinene.	A
Myrtus communis L. (Myretaceae)	Leaves	Volatile oil (mainly myrtol) and antibacterial substance myrtemcomulone A and B.	B
Nigella sativa L. (Ranunculaceae)	Seeds	Glycosides, volatile oil and amino acids mainly cystine, lysine and glutamic acid.	B
Ocimum bosilicum L. (Labiatae)	Leaves	Volatile oil (0.4-0.5%) mainly linalol 65% and tannins	A
Pulicaria crispa (Forssk) Benth. (Compositae)	Leaves	Volatile oil , B- sitosterol, B- amyrin, cholin and neutral triterpene.	A
Ruta chalepensis (Rutaceae)	Leaves	Volatile oil and glycosides	B
Salvadora persica L. (Salvadoraceae)	Fresh leaves	Alkaloids namely steroidal alkaloids	B
Salvadora persica L. (Salvadoraceae)	Dry leaves	The same constituents of fresh leaves	B
Tamarindus indica L. (Leguminosae)	Leaves and fruits	Citric acid, tartaric acid and malic acid	B
Thymus vulgaris L. (Labiatae)	Leaves	Thyme oil (55% phenols)	B
Zizyphus jujuba L. (Rhamnaceae)	Leaves	Vitamin C , zizyphic and tannic acid.	B

A: Soaked method. B: Boiling method. C: Stain method.

b. Boiling method

Ten grams of the dried or 25 grams from the fresh plant materials were covered with 150 ml of sterile distilled water and the mixture was subjected to gentle heat for one hour until obtaining about 100 ml mixture, then filtered as previously mentioned.

C. Staining method

Twenty grams of the flour leaves of the Lawsonia inermis were homogenized for 30 sec. with 100 ml of distilled water/ethanol 95% (4:1). The solvent from the extract was removed in vacuo below 50C and the resulting dry total extract redissolved in 100 ml distilled water.

Aliquots of these extracts (0.1 ml) were used for testing the antimicrobial activity.

Test organisms

Three bacterial and two yests genera were used as test organisms. Table 2 contains the list of these organisms.

Specimens collection, isolation media, cultivation of the isolates and biochemical tests for purpose identification were carried out following the methods discussed by Sydney and Ellen (1986) .

Antimicrobial tests

Sensitivity of the tested organisms to different tested plant extracts was determined using the microbial broth dilution method according to National Committee for Clinical Laboratory Standards NCCLS (1985), by using computerized spectrophotometer (Selecto. Com.) Model CV-530/550156 a 570 Spe.), Spin (nm 480).

TABLE 2. List of tested microorganisms .

Organisms	*Source of isolation*
1-*Escherchia coli*	Human urine
2-*Staphylococcus aureus.*	Human throat
3-*Pseudomonas aeruginosa.*	Human nose
4-*Candida albicans.*	Human foot
5-*Saccharomyces cerevisiae*	Microbial culture collection centre in fac- of Science, Taiz Univ; Yemen

Results and Discussion

The sensitivities of tested organisms to different medicinal plants are presented in Fig. 1. Considering that the inhibition effect of the tested plants on the growth of tested organisms was higher than 50%, the results revealed that extracts of tested plants inhibited the growth of *Staphylococcus aureus* with relatively high rate (31.8%), of the total number of the tested plants (Table 3). These plants were : *Salvadora persica* - dry leaves -(0.4%); *Hibiscus sabdariffa* (5.2%); *Foeniculum vulgare*-seeds-(13.6%); *Catha edulis* (26.4%) ; *Tamarindus indica* (31.3%) ; *Lawsonia inermis* (43.5%); *Thymus vulgaris* (45.6%) and *Ruta chalepensis* (47.7%) (Fig.1) . These results confirm the data recorded by Iwu *et al.* (1999) and Kadry *et al.* (1998) who adopted that such plants have a potent antibacterial and fungicidal effect . But plants having no effect on *Staphylococcus aureus* represented 18% (Table 3) , these plants as shown in Fig. 1 *Allium cepa ; Capsicum annum ; Salvadora persica*-fresh leaves - *and Nigella sativa.*

This is might be due to resistance of the tested microbial isolate . This agrees with McManus and Jones (1994) who announced that antibiotic-resistant strains possess genes encoding for antibiotic resistance where are usually located on DNA homologous to self-transmissible plasmids.

E.coli showed high resistance (100 % growth) against (41%) of the following plants : *Allium cepa* ; *Citrus sinensis ; Foeniculum vulgare* (leaves and seeds) ; *Salvadora persica* (fresh leaves) and *Ruta chalepensis* (Fig.1). Whereas , the following plants showed good effect against *E . coli* : *Salvadora persica* -dry leaves-(1.4 %) ; *Catha edulis* (24.2%) and *Hibiscus sabdariffa* (23.93 %) (Fig.1).

TABLE 3 . Percentage of plant extracts inhibited the tested isolates .

Isolates	*Inhibition percentage*		
	100% growth	*>50% inhibition*	*<50% inhibition*
Staphylococcus aureus	18%	31.8%	50.2%
Escherchia coli	41%	18.2%	40.8%
Pseudomonas aeruginosa	23%	41%	36%
Candida albicans	-	81.8%	18.2%
Saccharomyces cerevisiae	-	36.3%	63.7%

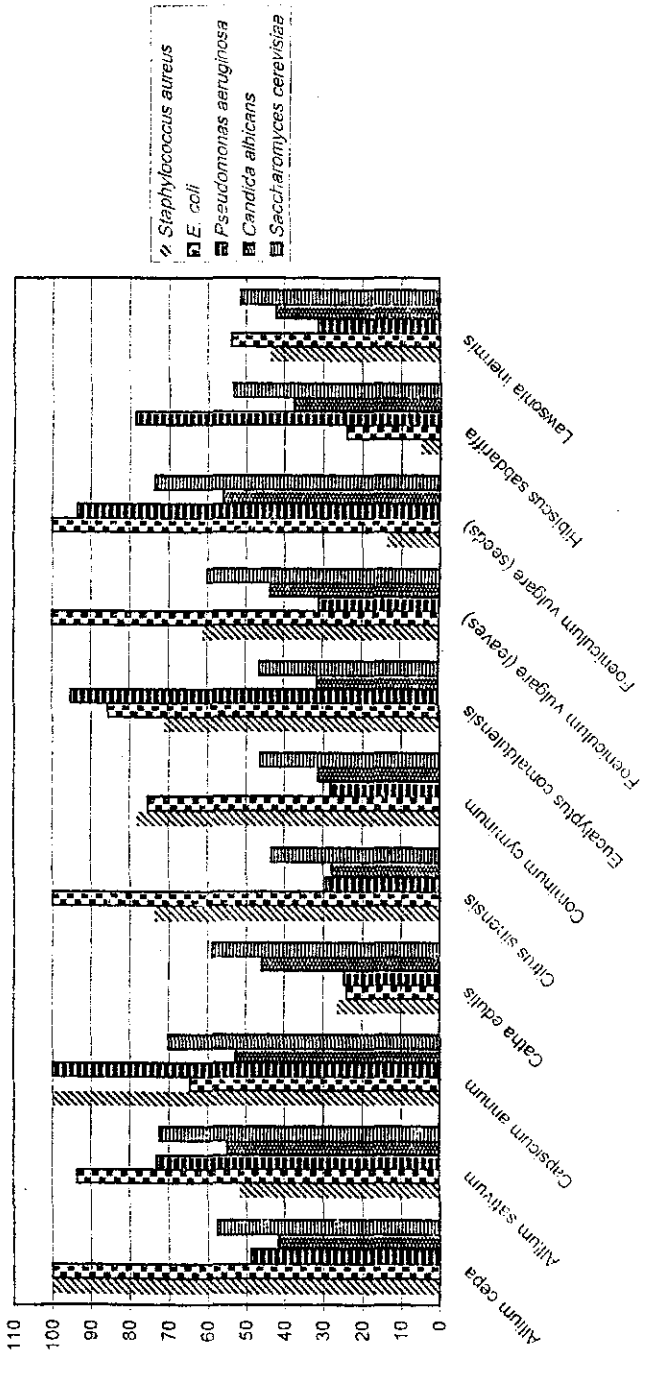

Fig .1. Antimicrobial activity of the tested plant extractions on the isolated microorganisms .

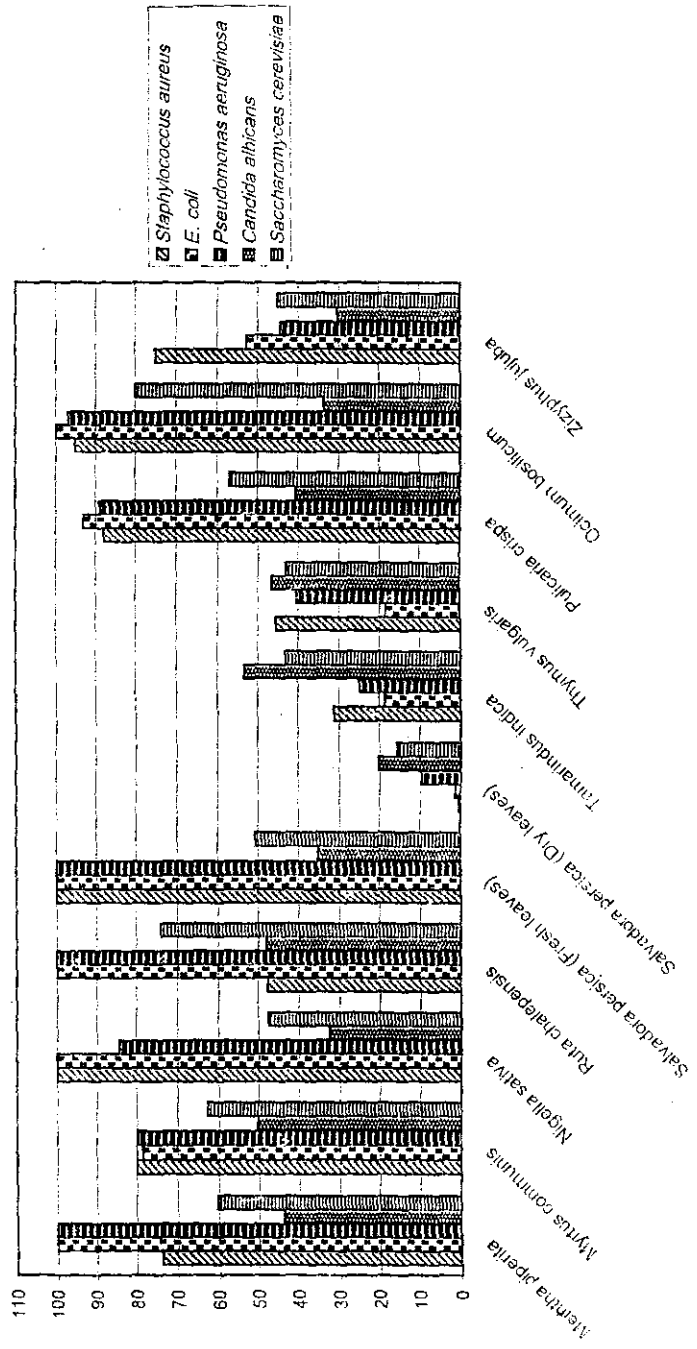
Staphylococcus aureus
E. coli
Pseudomonas aeruginosa
Candida albicans
Saccharomyces cerevisiae
Ziziphus jujuba
Ocimum bosilicum
Pulicaria crispa
Thymus vulgaris
Tamarindus indica
Salvadora persica (Dry leaves)
Salvadora persica (Fresh leaves)
Ruta chalepensis
Nigella sativa
Myrtus communis
Mentha piperita
110
100
90
80
70
60
50
40
30
20
10
0

Fig. 1. (Cont.).

The results listed in Fig. 1, suggested that the following plants showed good antibacterial potency against the isolate *Pseudomonas aeruginosa* : *Tamarindus indica* (24.9%); *Citrus sinensis* (29.3%); *Foeniculum vulgare* - leaves- (30.97%); *Lawsonia inermis* (31.1%); *Thymus vulgaris* (40.5%) and *Allium cepa* (48.8%) , extracts of : *Capsicum annum ; Mentha piperita ; Salvadora persica* (fresh leaves) and *Ruta chalepensis*, showed no activity .

The plants which caused an actual inhibition effect on *Candida albicans* represented (81.8%) of the total of tested plants (Table 3) .These plants Were : *Salvadora persica*- dry leaves - (20.2%) ; *Citrus sinensis* (28.7%) ; *Zizyphus jujuba* (30.43%) ; *Cuminum cyminum* (31.25%) ; *Eucalyptus camaldulensis* (31.34%); *Nigella sativa* (32.6%) *Salvadora persica* -fresh leaves -(35.3%) ; *Ocimum bosilicum* (39.6%); *Thymus vulgrais* (46.7%); *Pulicaria crispa* (40.6%); *Hibiscus sabdariffa* (37.6%) ; *Lawsonia inermis* (42.09%);*Mentha piperita* (43.9%);*Foeniculum vulgare*-leaves- (43.61%), *Ruta chalepensis* (48.1%); *Allium cepa* (41.6%) and *Catha edulis* (45.8%) But plants showing no effect, completely absent , because *C.albicans* showed good sensitivity to all tested plant extracts (Fig.1). *Saccharomyces cerevisiae* showed less sensitivity in comparison with *C.albicans* . The results that the following plants were found to be highly effective . *Salvadora persica* - dry leaves -(15.6%); *Tamarindus indica* (43.2%); *Citrus sinensis* (43.2%) *Thymus vulgaris* (43.2%); *Eucalyptus camaldulensis* (46.2%); *Cuminum cyminum* (46.2%); and *Nigella sativa* (47.6%).While , the other tested plants have variable effects against *S.cerevisiae* (Fig.1).

Yeasts in general were found to be more sensitive to a large number of the tested plants than bacteria . This agrees with findings of Iwu *et al.* (1999). Sanaa & Zeinab (1995) and Mariee *et al.* (1988).

Finally, it is essential to remind that utilization of the medicinal plants as folk medicine must be done with care and caution .

References

Al-khulaidi, A.A. (1989) A comparative survey of four physiographic regions in Y.A.R, T.C. Enschede, the Netherlands.

Bazeeb, S.A. (1993) *Medicinal Plants in Yemen.* El-Ershad library, Sanaa, Yemen (in Arabic).

Boakye- Yiadom, K., Flagbe, N. and Ayim, S. (1997) Antimicrobial properties of some West African medicinal plants 1V. Antimicrobial acticity of xylopic acid and other constituents of the fruits of *Xylopia aethiopica. Lloydia,* **40**,6:543

Chaudhary, S.A. and Reveri, R. (1983) Weeds of North Yemen, German Agency for technical Cooperation (GTZ) . Eschborn.

Farnsworth, N.R. (1984) A computerized data for medicinal plants, *World Health Forum* **Vol.** 5,No. 4,pp. 373-376.

Fauci, A. (1998) New and reemerging diseases , the importance of biomedical research. *Emerging Infections Diseases*, **4**, 3.

Iwu, M.W., Duncan, R.A. and Okunji, O.C. (1999) New antimicrobials of plant origin . p. 457-462. In : J.Janik (Ed.), *Prespectives On New Crops And New Uses.* ASHS Press, Alexandria, VA.

Kadry, A.H., Makboul, A.M. and Al-Douri, A.N. (1998) Chemistry of Natural Products. **Vol.** 2.Dar Al-Hamid for publishing and distribution , Amman, Jordan.

McManus, P.S. and Jones, A.L. (1994) Epidemiology and genetic analysis of exytetracycline for control. *Phytopathology* , **84**, 6, p. 627.

Mariee, N.K., Khalil, A.A., Nasser, A.A., Al-Hiti, M.M. and Ali, W.M. (1998) Isolation of the antimicrobial alkaloid stemmadenine from Iraqi Rhazya Stricta. J. *Natural Products*, **51**,1,186.

National Committee for Clinical Laboratory Standards, NCCLS (1985) Reference agar dilution procedure for antimicrobial susceptibility testing of microbes; approved standard. *Order No. M11-A,* available from NCCLS, 771-East Lancaster.

Penelope, O. (1999) Complete Medicinal Herbal Plants. Academia International, Beirut, Lebanon.

Sanaa, M.A. and Zeinab, H.K. (1995) Study of antimicrobial plants. *Egypt. J. Microbial.* **30,** 3, p.455 .

Scholte, P.T. and Al-Khulaidi, A.A. (1989) The herbarium collection at the RLIP. Agricultural Research authority. Dhamar. Y.A.R.

Sydney , M.F. and Ellen , Jo. B. (1986) *Diagnostic Microbiology.* 7th ed., the C.V. Mosby Company.

(*Received* 1 /8 /2001 ;
accepted 31/ 3 /2003)

دراسة على النشاط التضاد ميكروبي بواسطة بعض النباتات الطبية اليمنية

محمد رضا متولي

قسم النبات -كلية العلوم - بنها- مصر.

تم في هذا البحث جمع ٢٢ نباتا طبيا من مدينة تعز وضواحيها بالجمهورية اليمنية . أجرى عمل عدة مستخلصات بطرق مختلفة من هذه النباتات واختبر النشاط التضاد ميكروبي لكل منها ضد ثلاثة من الأجناس البكتيرية وجنسين من الخميرة . حيث أوضحت النتائج التي تم الحصول عليها أن جميع المستخلصات النباتية المختبرة أظهرت تأثيرا مثبطا على كلا من: كانديدا ألبيكانس ، سكارومايسيس سير يفيسيا . بينما وجد أن ١٨٪ ، ٤١٪ ، ٣٣٪ من مجموع النباتات المختبرة لم تظهر أي تأثير على كلا من: *S. aureus, E.coli, P. aeruginosa* وقد وجد أن أكثر النباتات الطبية المختبرة فعالية: التمر هندي ، الزعتر ، الآراك (أوراق جافة) ، السدر ، الحناء ، الكركديه وكذلك القات.

قد وجد أن معظم المستخلصات أظهرت نشاطا عاليا ضد الميكروبات المختبرة خاصة الخميرة .

وتشير الدراسة إلى أنه يجب عمل دراسات فارماكولوجية وبيوكيميائية لمثل تلك النباتات قبل استخدامها في مجال طب الأعشاب.