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STUDIES ON THE BACTERIOSTATIC PROPERTIES OF HIGHER PLANTS OF KARACHI REGION

Part II

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Abstract. Radial diffusion assay of ethanolic extracts of 68 higher plants against 14 human pathogenic bacteria have been described. The extracts of 15 plants showed bacteriostatic activity against all the 14 test organisms; 42 plants exhibited varied degree of activity while the rest were found to be inactive.

Present communication is in continuation of a previous paper[1] dealing with the radial diffusion assay of crude extracts of plants of Karachi region for bacteriostatic activity. Available literature[2–6] on higher plants of Indo-Pakistan subcontinent had also been referred to. This report covers the result of another 68 wild and cultivated plants which were randomly collected irrespective of their medicinal importance. The basis for the selection of plants had been their availability in abundance.

Materials and Methods

Plants were collected in their flowering season during 1970–72 from different areas of Karachi. A few fresh medicinal herbs were purchased through the local venders. With the exception of a test organism, *Staphylococcus albus*, a nonpathogenic bacterium, which has been replaced by a pathogenic, *Streptococcus pyogenes*, the methods of extraction and testing remained unchanged. Zones of inhibition of growth were measured in cm.

Results and Discussion

Details of the comparative results obtained are given in Tables 1 and 2. The plant extracts showing activity against different type of bacteria have been described in Table 1 and those extracts which showed bacteriostatic activity against the bacteria tested (Table 2). The extracts of plants which did not show bacteriostatic activity against all any of the 14 test organisms are: *Aloe vera; Asphodelus tenuifolius; Brachiara erucaeformis; B. ramosa; Cassia angustifolia, Commelina albescens; Cyperus arenarius; Imperata cylindrica; Melilotus albus; Paspallium distichum;* and *Sensiviera trifasciata.*

Cocculus pendulus fruits and leaves of *S. pedicellata* reputed[5] for the cure of fever exhibited B and C category zones against typhoid causing organism—*S. typhosa, S. para A* and *S. para B.* A number of other plants, as enumerated in Tables 1 and 2, however, showed A and B category zones.

C. rotundus, roots of *A. racemosus*, leaves and bark of *B. racemosa* did not show antidysenteric[5] and antidiarrhoeic[5] properties against *Sh. dysenteriae* and *Sh. flexineri*, although they have commonly been used in Unani(Greco-Arab) and Ayurvedic (ancient Indian) system of medicine.

Another plant beside *C. procera* reputed[5] for the cure of cholera, exhibited A category zone against *Vibrio cholera* ElTor.

TABLE 1. ETHANOLIC EXTRACTS OF PLANTS SHOWING BACTERIOSTATIC ACTIVITY WITH DIFFERENT ORGANISMS.

Aizoaceae

Trianthema crystallina (Forsk) Vahl—
2C, 3C, 4C, 5C, 7C, 10C, 11C and 14C.
T. pentandra (L.) Mantiss—
2C, 3C, 7A, 8C, 11C, 12C and 13C.
T. portulacastrum (Lal sabuni) Linn—
1C, 2C, 3C, 7B, 8C, 9C, 10B, 11C, 13C and 14C.

Amaranthaceae

Achyranthes aspera (Latjira) Linn—
1C, 2B, 3C, 5C, 7C, 8B, 10C, 11B, 12C, 13C and 14C.
Aerva javanica (Burm. f.) Juss—
2C, 3C, 7C and 13B.
Amaranthus viridis Linn—
1B, 2C, 9B, 11C and 14C.
Digera alternifolia (L.) Aschers—
8B and 11B

Asclepediaceae

Calotropis procera (Aak) Wild R. Br.—
(i) leaves—3C, 6C
(ii) flowers—7B, 9C, 11B and 13C

Cactaceae

Opuntia dillenii (Nagphani)Haw—
3C, 5B, 6B, 7C, 8C, 10C, 11B, 12C, 13B and 14C.

Caesalpiniaceae

Bauhinia racemosa (Kachnal) Linn—
leaves—1B, 3C, 5C, 7B, 8B, 10C and 11C
stem bark—7B and 10C
Cassia occidentalis (Kasondi) Linn. legumes—
4C, 12C and 13B
C. surrattense—
1C, 2B, 3A, 4B, 5B, 6C, 7C, 8A, 9B, 11A, 12A, 12C, 13C and 14A.

Capparidaceae

Capparis decidua (Forsk) Edgew—
3C, 4C, 5B, 7C and 8B.

(Continued)

(*Table* 1 *continued*)

Cleome viscosa (Hulhul) Linn—
7B, 11A and 13B.

Graminae

Antigonon leptopus Hk. f. & Arn—
2A, 5A, 7B, 8A, 11B, 12A and 13A.
Artisida hystricula Edgew—
3A and 14C.
Brachiara sp.—
3C, 7C, 8A, 9C, 12C and 13B.
Chloris barbata Sw.—
7C and 11C.
Chloris sp.—
2C, 3B, 4C, 5C, 7B, 8B, 9C, 10B, 11C, 12C and 13C.
Cyperus rotundus (L.)—
3C, 7B, 8C, 9C, 11B and 14B.
Dactyloctenium scindicum-Boiss—
7C and 11C.
Hackelochloa granularis (Dhaturo ghas) (L.) Kuntze—
1C, 3C, 7B, 8B and 11C.
Pennisetum typhoides (Bajra) (Burm. f.) Stapf.—
2C, 4C, 13C and 14B.
Sporobulus marginatus Hoechst ex. A. Rich—
1C, 4C, 7C, 8C, 9B, 11B, 12B and 14B.
S. scindicus Stapf. ex. T. Cooke—
5C, 6C, 8C, 9B and 10B.

Labiatae

Ocimum basilicum (Munjarik) Linn—
1C, 3C and 12C.
O. sanctum (Tulsi) Linn.—
1C, 2C, 3B, 6C, 10A, 11C and 14C.

Lauraceae

Actinodaphne hookeri (Tali) Meissn—
(i) bark—1C, 2C, 3B, 4B, 7C, 9C, 10B, 11C, 12C, 13C and 14B.

Liliaceae

Asparagus racemosus (Satamuli)—
7C, 9C.

Meliaceae

Azadirachta indica (Nim) A. Juss—
(i) leaves—3B, 4C, 5B, 7C, 8B, 11B and 14C.
(ii) stem bark—4C, 5B, 8C, 11C and 14C.
Melia azadrach (Bakain)—
12C and 14C

Menispermaceae

Cocculus pendulus (Parwati) (Forst) Diels—
2B, 7B and 11C

Moringaceae

Moringa olifera (Drum stick) Lam—
(i) twigs—1B, 2C, 3B, 4B, 6B, 8B, 11B, 12C, 13B and 14B.
(ii) flowers—3B, 4B, 5B, 6B, 11B, 13C and 14C.
(iii) bark—10C and 11C.

Nyctaginaceae

Boerhaavia verticillata Poirr—
3C, 6B, 7B, 8C, 10A and 11B
Mirabilis jalapa (Gul-e-abbas) Linn.—
1B, 2C, 3B, 5B, 7C, 9C, 10C, 11B, 12C, 13C and 14C.

Papilionaceae

Crotalaria burhia Ham. ex. Bth—
3B, 4B, 7C, 13C and 14A.

Scrophuliaceae

Schweinfurthia pedicillata (T. And.) Benth & Hooker—
1C, 2C, 3C, 4C, 6C, 8C and 11C.

Tiliaceae

Corchorus tricularis (Kadu kust)Linn—
1B, 2B, 6C, 9A and 11A.
Grewia asiatica (Phalsa) Linn—
(i) stem bark—3B, 4C, 8C, 9B, 10C, 11B and 13C.
G. tenax (Forsk) A & S—
4B and 8B

Verbenaceae

Clerodendrum phlomidis L.f. Arni—
1C, 2C, 3C, 7B, 8C, 9C, 10B, 11C, 13C and 14C.
Lippia nodiflora (Bakan buti) (L.) Rich.—
10C and 12B.

Table 2. Ethanolic Extract of Plants Showing Bacteriostatic Activity against All the 14 Test Bacteria.

Asclepidiaceae

Pentatropis spiralis (Bonveri) (Forsk) Decene—
1B, 2C, 3B, 5C, 6C, 7C, 8B, 9B, 10C, 11B, 12C, 13C and 14C

Caesalpineae

Cassia elata—
1C, 2B, 3C, 4B, 5B, 6B, 7B, 8B, 9C, 10C, 11B, 12C, 13B and 14C
C. holosericae (Jangli senna) Fresen—
1B, 2C, 3B, 4C, 5C, 6C, 7C, 8C, 9C, 10C, 11C, 12C, 13C and 14C.
C. occidentalis (Kasondi) Linn.—
(i) shoot—1B, 2B, 3B, 4C, 5C, 6C, 7C, 8C, 9C, 10B, 11A, 12B, 13B and 14A.

Crassulaceae

Bryophyllum calycinum (Patter chatta) Salisb.—
1C, 2B, 3C, 4B, 5B, 6C, 7C, 8C, 9B, 10C, 11B, 12C, 13C and 14C.

Fumaraceae

Fumaria parviflora (Shatra) Auct.—
1B, 2B, 3B, 4B, 5B, 6C, 7B, 8A, 9A, 10B, 11B, 12C, 13C and 14B.

Lauraceae

Actinodaphne hookeri (Tali) Meissn—
(i) shoot—1B, 2C, 3B, 4B, 5C, 6C, 7B, 8C, 9C, 10C, 11C, 12C, 13C and 14C.
Cinnamomum zeylanicum (Darchini) Breyn—
1A, 2B, 3B, 4B, 5B, 6C, 7B, 8B, 9B, 10B, 11B, 12C, 13C and 14B.

Liliaceae

Allium sativum (Garlick-Lehsun) Linn—
1B, 2B, 3B, 4B, 5B, 6B, 7B, 8C, 9B, 10B, 11B, 12B, 13B and 14B.
Sensiviera laurentii (N.E.Br.) DeWild—
1B, 2B, 3C, 4B, 5C, 6B, 7C, 8C, 9B, 10C, 11C, 12C, 13B and 14C.

(*Continued*)

(*Table 2 continued*)

Oxalidaceae

Oxalis corniculata Linn.—
1C, 2C, 3C, 4C, 5C, 6C, 7C, 8C, 9C, 10B, 11C, 12B, 13C and 14C.
O. Corymbosa DC—
1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B, 9B, 10A, 11B, 12A, 13B and 14B.

Papillionaceae

Melilotus indicus (L.) All—
1B, 2C, 3B, 4C, 5B, 6B, 7B, 8B, 9B, 10B, 11B, 12C, 13C and 14B

Tamarindus indica Linn (Imli).—
(i) leaves—1C, 2B, 3B, 4B, 5C, 6C, 7C, 8B, 9B, 10C, 11B, 12B, 13C and 14C.
(ii) bark—1B, 2B, 3B, 4B, 5C, 6A, 7B, 8B, 9B, 10C, 11C, 12B, 13B and 14B.
(iii) seeds—1C, 2B, 3B, 4A, 5C, 6C, 7B, 8B, 9C, 10C, 11C, 12B, 13B and 14B.

Sapindaceae

Dodonea viscosa (Zakhmi) (L.) Jacq.—
1C, 2C, 3B, 4B, 5B, 6B, 7B, 8B, 9B, 10B, 11A, 12B, 13B and 14B.

Schleichera oleosa (Kusum) Linn.—
1B, 2B, 3A, 4C, 5B, 6C, 7A, 8C, 9C, 10B, 11C, 12B, 13B and 14B.

Scrophulariaceae

Herpestis monniera (Bama) H.B. & K—
1B, 2B, 3B, 4B, 5B, 6B, 7B, 8B, 9B, 10C, 11B, 12B, 13B and 14B.

The results presented may be viewed as approximation rather than as data of absolute validity, as leads rather than findings, since the antibacterial principles may change in the course of development of a plant. Even environmental factors may bring out an active principle or diminish it.[8] Further the inhibition of bacterial growth may have been due to a cumulative effect of other constituents of the plant rather than a single active principle. It is known that certain drug when administered orally undergoes certain changes in the course of its passing through the alimentary canal. It is possible that substances may undergo hydrolysis or other chemical transformation and thus would have a marked influence on their activity. So far the tests have been conducted *in vitro* only, hence their application could not be assured unless tests *in vivo* are complete. For the purpose of incorporating them for human body, their toxicity and interaction with blood constituents must be known.

The results clearly show that antibacterial principles are common in higher plants and that perhaps the activity would have not been detected earlier because of high dilution or low potency. Obviously a very fertile field of study is open to the biological scientist. The screening of plants for antibacterial activity is to be continued.

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Details of the topographical figures used in the tables are as follows:

Activities of plants have been categorised according to the dia of inhibition zones of growth shown by extracts.

Zones with average dia 5·0–8·5, 3·0–4·9 and 1·5–2·9 cm were represented by A, B and C respectively.

No. 1 to 14 represent name of organisms as follows:

1. *Salmonella typhosa*
2. *S. para A*
3. *S. para B*
4. *Shigella dysenteriae*
5. *S. flexneriae*
6. *Escherichia coli*
7. *Klebsiella pneumoniae*
8. *Streptococcus faecalis*
9. *S. pyogenes*
10. *Vibrio cholera* Inaba
11. *V.C. ElTor*
12. *Staphylococcus aureus*
13. *Diplococcus pneumoniae*
14. *Corynebacterium diphteriae*

References

1. M. S. Attia, S. Ahmad, S. A. H. Zaidi and Z. Ahmed, Pakistan J. Sci. Ind. Res., **15,** 199 (1972).
2. G. Watt, *A Dictionary of Economic Products of India* (W.H. Allen, India, 1889–1893), vol. I–VI.
3. *Wealth of India* (CSIR, New Delhi, 1952–1962), vol. II–VI.
4. A.K. Nadkarni, *Indian Materia Medica* (Popular Book Depot, Bombay, 1959), vol. I and II.
5. R.N. Chopra, *Chopras' Indigenous Drugs of India* (Dhur, Calcutta, 1958).
6. S.R. Baquar and M. Tasnif, *Medicinal Plants of Southern-West Pakistan* (PCSIR monograph No. 3, 1967).
7. N.G.F. Reddish, J. Lab. Clin. Med., **14,** 649 (1929).
8. E.H. Lucas, Ardeth Frisbey, R.Y.Gottshall and J.C. Jenning, Bull. Mich. Agr. Exptl. Sta., **37,** 425 (1955).