*Pak. J. Bot.*, 38(4): 1245-1248, 2006.

# *IN VITRO* NEMATICIDAL ACTIVITIES OF SEAWEED EXTRACTS FROM KARACHI COAST

**MUHAMMAD AFZAL RIZVI [1] AND MUSTAFA SHAMEEL[2]**

[1]*HIASR, Hamdard University, Madinat al-Hikmah, Karachi-74600,*
[2]*Department of Botany, University of Karachi-75270, Pakistan.*

**Abstract**

Twenty two species of seaweeds viz., *Asparagopsis taxiformis, Botryocladia leptopoda, Caulerpa racemosa, Caulerpa scalpelliformis, Caulerpa taxifolia, Codium iyengarii, Cystoclonium purpureum, Cystoseira indica, Dermonema abbottiae, Dictyota dichotoma* var. *intricata, Gelidium usmanghanii, Gracilaria foliifera, Gracilaria gracilis, Iyengaria stellata, Jolyna laminariodes, Melanothamnus afaqhusainii, Padina antillarum, Sargassum tenerrimum, Spatoglossum variabile, Stoechospermum polypodioidis* were collected from the coastal areas (Manora, Buleji, Paradise Point) of Karachi, Pakistan. Methanol extracts of the seaweeds were tested for nematicidal activity against the larvae of *Meloidogyne javanica* root knot nematode. *Stoechospermum polypodioides* appeared to be the most active seaweed as it caused 80 % mortality of the nematode larvae after 72 h exposure to its extract. *Jolyna laminarioides* was found to be least active in its nematicidal activity since it caused only 21 % mortality after the exposure of 48 as well as 72 h of its extract. Three species of *Caulerpa* and 2 of *Gracilaria* presented specific differences regarding their nematicidal activities.

## Introduction

In Pakistan a number of seaweeds as well as medicinal plants are found growing naturally. Like other plants, medicinal plants are also affected by a large number of diseases caused by fungi, bacteria, nematodes etc., (Ghafoor & Khan, 1976). The useful medicinal plants such as *Coriandrum sativum*, *Coleus forsskohlii*, *Elaeis guineensis*, *Hyoscyamous niger*, *Hyssopus officinalis*, *Lallmentiana roylana*, *Panax ginseng*, *Rauwolfia serpentina* are reported to be infested by root-knot disease (Janardhanan, 2002). Pesticides are generally used for the control of pests and diseases. An alternative control strategy of nematode should be developed which may be safe and cost effective (Abid *et al*., 2005). The present study describes the results of different groups of seaweeds against root-knot nematode which may be of great help to prevent the root diseases in econo-medicinal plants.

## Materials and Methods

Collections were made from Manora, Buleji and Paradise Point, the coastal areas near Karachi (Pakistan). The methods used for the collection and study of the seaweeds were the same as described previously (Rizvi & Shameel, 2003). The crude gummy methanol extracts (6 mg) of each seaweed were tested for *in vitro* nematicidal activity against *Meloidogyne javanica* a root-knot nematode. The assay was carried out in triplicate, as presented in Fig. 1.

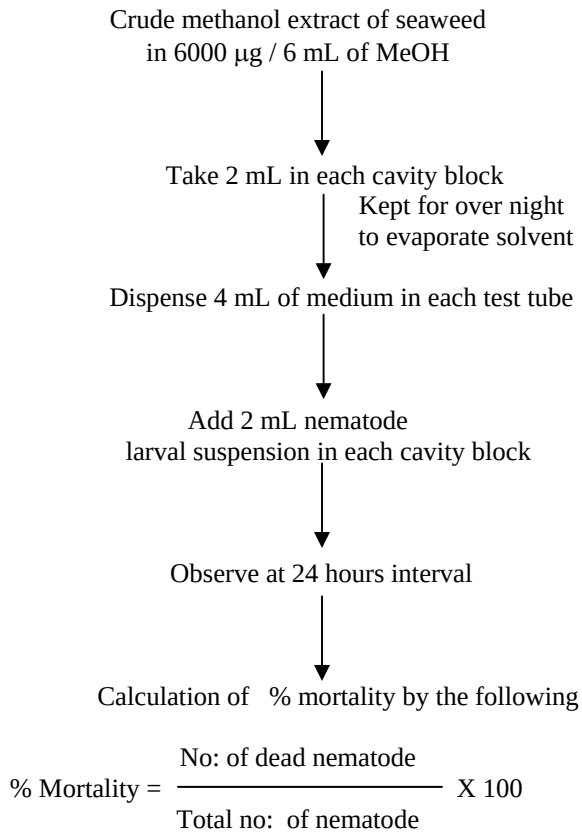


Fig. 1. The nematicidal assay.

A 1000 µg/mL solution in MeOH was prepared from gummy residue poured in glass cavity blocks @ 2 mL / cavity block and kept open for 48 h to evaporate the methanol. Egg masses of root - knot nematode obtained from a pure culture maintained on brinjal (*Solanum melongara* Linn.) roots were placed on sterilized distilled water and incubated for 24 h at room temperature for hatching. Freshly hatched larval suspension of $2^{nd}$ stage juveniles @ 2 mL/cavity block was poured in each cavity block containing crude extract and placed at room temperature. Cavity blocks without any crude extract served as control. The number of dead juveniles was recorded after 24, 48, and 72 h using a stereoscopic microscope (x6). Mortality was confirmed by touching the larvae with fine needle (Atta-ur-Rahman *et al*., 1997).

**Results and Discussion**

Of the various species of seaweeds tested for nematicidal activity against larvae of *Meloidogyne javanica* root-knot nematode (Table 1), *Stoechospermum polypodioides* appeared to be the most active seaweed, as it caused 80 % mortality of the nematode larvae after 72 h exposure to its extract. *Jolyna laminarioides* was found to be least active in its nematicidal activity, as it caused only 21 % mortality after the exposure of 48 as

well as 72 h of its extract. Within Chlorophyta, the members of the class Ulvophyceae were more active than those of the class Siphonocladophyceae. Seaweeds of the class Laminariophyceae showed lesser activity than those of other two classes of Phaeophyta, which hardly presented any traceable difference. Among Rhodophyta members of the class Nemaliophyceae were less active than those of the class Ceramiophyceae.

**Table 1. Comparative *In vitro* nematicidal activities of methanol extracts of seaweeds**.

| Seaweeds | Exposure time (hours) | | |
|---|---|---|---|
| | 24 | 48 | 72 |
| | % Larval mortality | | |
| **Cholorophyta** | | | |
| *Ulva intestinalis* L. | 6 | 10 | 60 |
| *Ulva fasciata* Delile | 15 | 21 | 55 |
| *Codium iyengarii* Børg. | 3 | 14 | 46 |
| *Caulerpa racemosa* (Forssk.) J. Ag. | 6 | 7 | 42 |
| *Caulerpa scalpelliformis* (R. Br.) C. Ag. | 1 | 15 | 53 |
| *Caulerpa taxifolia* (Vahl) C. Ag. | 26 | 33 | 40 |
| **Phaeophyta** | | | |
| *Dictyota dichotoma* var. *intricata* (C. Ag.) Greville | 18 | 24 | 76 |
| *Padina antillarum* (Kütz.) Piccone | 10 | 14 | 51 |
| *Spatoglossum variabile* Fig. *et* De Not | 16 | 21 | 50 |
| *Stoechospermum polypodioides* (J.V. Lamour) J. Ag. | 40 | 70 | 80 |
| *Jolyna laminarioides* Guimareãs | 15 | 21 | 21 |
| *Iyengaria stellata* (Børg.) Børg. | 20 | 26 | 69 |
| *Cystoseira indica* (Thivy *et* Doshi) Mairh | 4 | 31 | 72 |
| *Sargassum tenerrimum* J. Ag. | 2 | 12 | 68 |
| **Rhodophyta** | | | |
| *Dermonema abbottiae* Afaq., Nizam. *et* Shameel | 7 | 11 | 33 |
| *Gelidium usmanghanii* Afaq. *et* Shameel | 14 | 21 | 55 |
| *Gracilaria foliifera* (Forssk.) Børg. | 10 | 21 | 71 |
| *Gracilaria gracilis* (Stackhouse) Steentoft *et al.* | 3 | 17 | 51 |
| *Asparagopsis taxiformis* (Delile) Trevisan | 11 | 21 | 50 |
| *Cystoclonium purpureum* (Huds.) Batt. | 14 | 19 | 62 |
| *Botryocladia leptopoda* (J. Ag.) Kylin | 7 | 12 | 48 |
| *Melanothamnus afaqhusainii* Shameel | 15 | 20 | 67 |

When compared among themselves, the 3 species of *Caulerpa* and 2 of *Gracilaria* presented specific differences regarding their nematicidal activities. On the average the species of brown seaweeds were found to be most active and those of green seaweeds least active, while the members of red seaweeds presented an intermediate value of nematicidal activity. In other studies also the aqueous and ethanol extracts of *Stoechospermum polypodioides* were found to display strong nematicidal activities against the larvae of *Meloidogyne javanica* (Abid *et al*., 1993, Sultana *at al*., 2000). When compared with green and red seaweeds the marine brown algae from the coast of Pakistan as well as those of other coastal areas have always exhibited much stronger nematicidal activities against juveniles (Ara *et al*., 1996; Sultana *et al*., 2000; Noreen *et al*., 2002; Whapham *et al*., 1994; Zaki *et al*., 2005).

The nematicidal activities of seaweeds would be a great help to prevent or at least reduce the root diseases in valuable plants, which cause serious losses to crop plants and adversely affect the botanical gardens and agricultural economy of our country.

**References**

Abid, M., M.J. Zaki and M.A. Maqbool. 1993. Use of the brown alga *Stoechospermum marginatum* for the control of root-knot nematode in bringal. *Mar. Res*., 2: 39-44.

Abid, M., M.J. Zaki, M.Q. Khan and A. Sattar. 2005. Use of marine algae for the management of root-knot nematode (*Meloidogyne javanica*) in okra and tomato plants. *Int. J. Phycol. Phycochem*., 1: 187-192.

Ara, J., S. Ehteshamul-Haque, V. Sultana, R. Qasim and A. Gaffar. 1996. Nematicidal activity of seaweeds against *Meloidogyne javanica* root knot nematode. *Pak. J. Nematol*., 14: 129-131.

Atta-ur-Rahman, A.M. Khan, M. Shabbir, M. Abid, M.I. Chaudhary, A. Nasreen, M.A. Maqbool, M. Shameel and R. Sualeh. 1997. Nematicidal activity of marine organisms. *Pak. J. Nematol*., 15: 95-100.

Ghafoor, A. and S.A.J. Khan. 1976. *List of Diseases of Economic Plants in Pakistan.* Printing Corp. of Pakistan Press, Karachi, 85 pp.

Janardhanan, K.K. 2002. *Disease of Major Medicinal Plants*. Daya Publish., House Delhi, India, 189 pp.

Noreen A, Amer-Zareen, M. J. Zaki and M. Abid. 2002. Effect of seaweeds on population of *Verticillium chlamydosporium* and control of root-knot nematode on egg plant. *Proc. Nat. Symp. Nematol., Karachi*, 103-109.

Rizvi, M.A. and M. Shameel. 2003. Biological activity and elementology of benthic algae from Karachi coast. *Pak. J. Bot*., 35: 717-729.

Sultana, V., S. Ehteshamul-Haque, J. Ara and V. U. Ahmad. 2000. Utilization of seaweeds for the control of root diseases of tomato. *In*: *Proceedings of National ONR Symposium on Arabian Sea as a Resource of Biological Diversity*. (Ed.): V.U. Ahmad. HEJRIC, University of Karachi, p. 193-206.

Whapham, C.A., T. Jenkins, G. Blunden and S.D. Hankins. 1994. The role of seaweed extracts *Ascophyllum nodosum*, in the reduction in fecundity of *Meloidogyne javanica*. *Fund. Appl. Nematol*., 17: 181-183.

Zaki, M.J, Amer-Zareen, A. Sattar and M.Q. Khan. 2005. Effect of seaweeds on the efficacy of *Pasteuria penetrans* in the control of root-knot nematode, *Meloidogyne javanica* in eggplant. *Int. J. Phycol. Phycochem*., 1: 65-72.

(Received for publication 24 April 2006)