# DISTRIBUTION STATUS OF AM FUNGI FROM RHIZOSPHERE OF MEDICINAL PLANTS IN SELECTED AREAS OF KANYAKUMARI DISTRICT, TAMILNADU.

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## Abstract:

**Arbuscular Mycorrhizal Fungi (AMF) is a non - pathogenic symbiotic soil fungi which invade the root systems of plants. Arbuscular Mycorrhizal Fungi (AMF) is associated with about 80% of the plant families in the world. They enhance the uptake and translocation of mineral nutrients - mainly P, N, S, K, Ca, Fe, Cu and Zn from soil to the host plants. AM Fungi also play an important role to help the plants to tolerate the stressed condition in the soils polluted with heavy metals, industrial effluents, acid rain and biocides which affect the growth and establishment of plants Arbuscular Mycorrhizal Fungi can also induce changes in the accumulation of secondary metabolites including phenolics, in host plant roots. The present study was under taken to assess the AM fungal symbiosis in twelve commonly occurring medicinal plants in selected sites of Kanyakumari district, in southern India. This article pen drive the AM fungi from the rhizosphere of different medicinal plants in selected areas of kanyakumari district, Tamilnadu.**

**Keywords:** Accumulation, Arbuscular, Mycorrhizal, Phytochemical, Secondary metabolites.

## Introduction:

Arbuscular Mycorrhizal Fungi (AMF) is associated with about 80% of the plant families in the world (Giovannetti and Sbrana, 1998). They enhance the uptake and translocation of mineral nutrients - mainly P, N, S, K, Ca, Fe, Cu and Zn from soil to the host plants (Javot *et al*., 2007; Smith and Read, 2008; Giovannetti and Avio, 2001; Thompson 1987 and Sundar., *et al* 2010). AM Fungi also play an important role to help the plants to tolerate the stressed condition in the soils polluted with heavy metals, industrial effluents, acid rain and biocides which affect the growth and establishment of plants (Dakession., *et al.*, 1986 and Mosses, 1986). Medicinal plants are important for pharmacological research and drug development, not only as plant

constituents used directly as therapeutic agents but also a starting material for the synthesis of drugs or as models for pharmacologically active compounds (Mukherjee, 2003). There is only feeble information available on the occurrence of these effective micro organisms in medicinal plants of India especially in the state of Tamilnadu. Hence the present study was undertaken to survey the AM Fungal association in 36 medicinal plants in Kanyakumari District.

## Materials and Methods:

The investigation was carried out in 36 medicinally important plant species of herbs, shrubs and tree species belonging to 24 families were selected to study the response of plants to VAM Fungi. The medicinal plants were collected from different regions in Kanyakumari District, Tamilnadu. The rhizosphere soil samples were collected from all these 36 medicinal plant species to determine the status of different beneficial microbes.

### Collection of root samples:

The collected root samples was thoroughly washed in running tap water and rootlets were selected and cut in to small pieces and fixed in formaldehyde solution and were preserved in refrigerator at $4^{o}$c temperature.

### Collection of soil samples:

Soil sample of about 100gm was collected from the root region (Rhizosphere) of each of the plants by digging the soil up to a depth of 10cm and collected into polythene bags, labeled and stored in refrigerator for further observations. (Gerdemann and Nicolson,1963).

### Preparation of root samples:

For each medicinal plant, after washed in water boiled at $95^{o}$c for 30 minutes in 10% KOH. The segments are then washed in distilled water, acidified with 1(N) HCl and were stained with 0.05% trypan blue in lactophenol. The excess stain was removed by washing in lactophenol. Root segments were mounted temporarily on slides in acetic acid, glycerol (1:1 V/V) and the edges of the cover slips were sealed with DPX and observed under microscope.

### Assessment of VAM Fungal and spore count:

The VAM Fungal association with the roots of each of medicinal plants was isolated by following the method of (Philip and Hayman, 1970) and the percentage of mycorrhizal association was calculated. The Arbuscular Mycorrhizal Fungi were identified by using manuals of Trappe (1982) and Schenck and Perez (1990). VAM fungal spores were extracted from three replicates of 50 gm soil by wet sieving and decanting technique (Gerdeman and Nicolson, 1963). Using morphology and coloration of the spores, different AM Fungal genera in the present study were identified up to the generic level using the taxonomic keys of http://invam.caf.wvu.edu and Schenck and Perez (1990).

## Results and Discussion:

Root samples of thirty six (36) different medicinal plants were analyzed and estimated percent root colonization of AM fungi and data is presented in **Table 1**. It was observed that all the root samples had AM fungal colonization but variation in percent (%) colonization showing AM fungal hyphae/mycelia, vesicular and arbuscular structures. The Rhizosphere soil samples of thirty six (36) different medicinal plants was analyzed and estimated spore population density of AM fungi and data is presented in **Table 2**.

Among 36 different medicinal plants rhizosphere soil samples screened, AM fungal spore population was found maximum from the rhizosphere of *O. sanctum* (998/100 g soil) and this is followed by *A. paniculata* (995/100 g soil), *W. somnifera* (978/100 g soil), *T. procumbens* (977/100 g soil), *A. indica* (972/100 g soil), *K. pinnata* (956/100 g soil), *E. prostrata* (940/100 g soil), *C. zizanoides* (929/100 g soil), *C. asiatica* (920/100 g soil) and *S. trilobatum* (902/100 g soil). It was also found that total of four different AM fungal genera *viz.,Acaulospora, Gigaspora, Glomus* and *Scutellospora* were recorded from the rhizosphere of 36 different medicinal plants screened. Among the spore population of different AM fungi, the genus *Glomus* was found maximum population from the rhizosphere all the 36 different medicinal plants screened and this is followed by the AM fungal genus *Acaulospora*.

Data on the distribution of AM fungi recorded from the rhizosphere of thirty six different medicinal plants is presented in **Table 3.**Among the different species of the genus *Glomus* isolated, *Glomus fasciculatum* was found in association with thirty (30) different

medicinal plants and this is followed by *Glomus aggregatum* and *Glomus geosporum* from the rhizosphere of twenty five (25) different medicinal plants (each), Acaulospora scrobiculata and *Scutellospora* sp. from the rhizosphere of twenty two (22) medicinal plants (each) during the period of investigation. Among different AM fungi, *Glomus albidum* was found associated with four (4) different medicinal plants and this is followed by *Glomus maculosum* associated with six (6) different medicinal plants.

It was observed that all the root samples had AM fungal colonization but variation in percent (%) colonization. A total of 31 different species of AM fungi belonging to four genera such as *Acaulospora, Gigaspora, Glomus* and *Scutellospora* were isolated and identified from 36 different medicinal plants collected at Kanyakumari district, Tamil Nadu.

Among them, the genus *Glomus* was found most predominant AM fungus and 21 different *Glomus* species were recorded. Among the different species of the genus *Glomus* isolated, *Glomus fasciculatum* was found in association with thirty (30) different medicinal plants and this is followed by *Glomus aggregatum* and *Glomus geosporum* from the rhizosphere of twenty five (25) different medicinal plants (each), *Acaulospora scrobiculata* and *Scutellospora* sp. from the rhizosphere of twenty two (22) medicinal plants (each) during the period of investigation.

**Table 1. Mean percent root colonization of AM fungi in different medicinal plants**

| S.No. | Medicinal Plant Name | AM fungal status | | | Percent (%)root colonization* |
|---|---|---|---|---|---|
| | | Hyphae | Vesicles | Arbuscules | |
| 1 | *Acorus calamus* | ++++ | +++ | ++ | 78 |
| 2 | *Adathoda vasica* | +++ | ++++ | + | 77 |
| 3 | *Aegle marmelos* | ++ | ++ | - | 50 |
| 4 | *Aristolochia bracteata* | ++ | ++ | - | 47 |
| 5 | *Azadirachta indica* | ++++ | ++++ | ++ | 89 |
| 6 | *Centella asiatica* | ++++ | ++++ | + | 77 |
| 7 | *Cichorium intibus* | +++ | ++++ | ++ | 76 |
| 8 | *Eclipta prostrata* | ++++ | ++++ | + | 86 |

| | | | | | |
|---|---|---|---|---|---|
| 9 | *Gmelina arborea* | +++ | ++++ | - | 72 |
| 10 | *Gymnema sylvestre* | + | ++ | + | 35 |
| 11 | *Hemidesmus indicus* | ++ | ++ | + | 38 |
| 12 | *Hibiscua rosa-sinensis* | +++ | ++ | - | 59 |
| 13 | *Hygrophylla auriculata* | +++ | +++ | - | 62 |
| 14 | *Kalanchoe pinnata* | +++ | ++++ | ++ | 76 |
| 15 | *Limonia elephantum* | ++ | +++ | - | 54 |
| 16 | *Ocimum basilicum* | +++ | +++ | - | 68 |
| 17 | *Ocimum sanctum* | ++++ | ++++ | + | 80 |
| 18 | *Oxalis corniculata* | ++ | + | - | 50 |
| 19 | *Phyllanthus emblica* | ++ | ++ | - | 52 |
| 20 | *Phyla nodiflora* | +++ | +++ | + | 70 |
| 21 | *Plectranthus amboinicus* | +++ | ++ | + | 67 |
| 22 | *Rauvolfia tetraphylla* | ++ | + | - | 64 |
| 23 | *Solanum trilobatum* | +++ | +++ | - | 70 |
| 24 | *Santalum album* | +++ | +++ | - | 69 |
| 25 | *Strychnos nox-vomica* | ++ | + | - | 41 |
| 26 | *Tinospora cornifolia* | + | ++ | - | 33 |
| 27 | *Withania somnifera* | ++++ | +++ | + | 77 |
| 28 | *Aloe vera* | +++ | +++ | - | 59 |
| 29 | *Andrographis paniculata* | ++++ | ++++ | - | 84 |
| 30 | *Curcuma longa* | ++ | ++ | - | 59 |
| 31 | *Tridax procumbens* | ++++ | ++++ | + | 81 |
| 32 | *Chrysopogon zizanioides* | ++++ | +++ | - | 76 |
| 33 | *Costus igneus* | ++ | ++ | - | 58 |
| 34 | *Syzygium cumini* | +++ | ++++ | - | 77 |

| | | | | | |
|---|---|---|---|---|---|
| 35 | *Terminalia bellerica* | +++ | ++++ | - | 76 |
| 36 | *Terminalia chebula* | ++++ | +++ | + | 78 |

**All values mean of 6 Replications**

| | |
|---|---|
| + | Low 1-25% |
| ++ | Moderate 26-50% |
| +++ | Good 51-75% |
| ++++ | Very good 76-100% |
| – | Absent |

**Table 2. Mean spore population of AM fungi from the rhizosphere soil samples of different medicinal plants**

| S. No. | Medicinal Plant Name | AM fungal spore types | | | | Spore population/ 100 g soil* |
|---|---|---|---|---|---|---|
| | | *Acaulospora* | *Gigaspora* | *Glomus* | *Scutellospora* | |
| 1 | *Acorus calamus* | 296 | 68 | 502 | 32 | 898 |
| 2 | *Adathoda vasica* | 230 | 76 | 466 | 24 | 796 |
| 3 | *Aegle marmelos* | 77 | 36 | 153 | 14 | 280 |
| 4 | *Aristolochia bracteata* | 81 | 23 | 149 | 7 | 260 |
| 5 | *Azadirachta indica* | 264 | 28 | 668 | 12 | 972 |
| 6 | *Centella asiatica* | 273 | 33 | 597 | 17 | 920 |
| 7 | *Cichorium intibus* | 210 | 29 | 573 | 11 | 823 |
| 8 | *Eclipta prostrata* | 265 | 26 | 630 | 19 | 940 |
| 9 | *Gmelina arborea* | 260 | 31 | 587 | 9 | 887 |
| 10 | *Gymnema sylvestre* | 53 | --- | 69 | --- | 122 |
| 11 | *Hemidesmus indicus* | 49 | 7 | 87 | --- | 143 |
| 12 | *Hibiscua rosa-sinensis* | 140 | 22 | 207 | 18 | 387 |
| 13 | *Hygrophylla auriculata* | 217 | 19 | 545 | 11 | 792 |
| 14 | *Kalanchoe pinnata* | 245 | 47 | 641 | 23 | 956 |
| 15 | *Limonia elephantum* | 101 | 32 | 189 | --- | 322 |
| 16 | *Ocimum basilicum* | 210 | 35 | 422 | 25 | 692 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | *Ocimum sanctum* | 263 | 70 | 638 | 27 | 998 |
| 18 | *Oxalis corniculata* | 112 | 22 | 336 | 8 | 478 |
| 19 | *Phyllanthus emblica* | 83 | 7 | 277 | --- | 367 |
| 20 | *Phyla nodiflora* | 239 | 45 | 591 | 21 | 896 |
| 21 | *Plectranthus amboinicus* | 172 | 33 | 469 | 7 | 681 |
| 22 | *Rauvolfia tetraphylla* | 122 | 18 | 402 | --- | 542 |
| 23 | *Solanum trilobatum* | 150 | 29 | 706 | 17 | 902 |
| 24 | *Santalum album* | 115 | 12 | 379 | 6 | 512 |
| 25 | *Strychnos nox-vomica* | 111 | 9 | 209 | --- | 329 |
| 26 | *Tinospora cornifolia* | 30 | --- | 85 | --- | 115 |
| 27 | *Withania somnifera* | 295 | 36 | 633 | 14 | 978 |
| 28 | *Aloe vera* | 118 | 12 | 302 | --- | 432 |
| 29 | *Andrographis paniculata* | 190 | 42 | 745 | 18 | 995 |
| 30 | *Curcuma longa* | 95 | 9 | 331 | 6 | 441 |
| 31 | *Tridax procumbens* | 219 | 37 | 707 | 14 | 977 |
| 32 | *Chrysopogon zizanioides* | 204 | 26 | 699 | --- | 929 |
| 33 | *Costus igneus* | 115 | 12 | 355 | 5 | 487 |
| 34 | *Syzygium cumini* | 210 | 38 | 566 | 22 | 836 |
| 35 | *Terminalia bellerica* | 190 | 27 | 527 | 13 | 757 |
| 36 | *Terminalia chebula* | 152 | 19 | 604 | 9 | 784 |

**All values mean of 6 Replications**

**Table 3. Distribution of different AM fungi from the rhizosphere of different medicinal plants**

| S. No. | AM Fungi | Isolated from rhizosphere of medicinal plants |
|---|---|---|
| 1 | *Acaulospora* sp. | *C. intibus; G. sylvestre, H. auriculata; O. sanctum; K. pinnata, S. cumini, T. chebula, T. procumbens* |
| 2 | *Acaulospora scrobiculata* | *A. calamus; A. marmelos; A, indica; A. paniculata*; *A, vasica*; *A. vera*; *C. asiatica; C. igneus; E. prostrata; G. arborea; H. rosa-sinensis; L. elephantum; O, basilicum; O. sanctum; P. amboinicus; P. nodiflora; S. album; S. procumbens; S. trilobatum; T. bellerica; T. cordifolia; W. somnifera* (22 plants) |

| S. No. | AM Fungi | Isolated from rhizosphere of medicinal plants |
|---|---|---|
| 3 | *Acaulospora laevis* | *A. bracteolata; H. indicus; O. corniculata; S. cumini; T. bellerica; T. chebula; W. somnifera* |
| 4 | *Acaulospora bireticulata* | *A. calamus; A. indica; C. longa; C. zizanoides; P. emblica; R. tetraphylla; S. nux-vomica* |
| 5 | *Gigaspora* sp. | *A. calamus; A. vasica; C. asiatica; K. pinnata; O. sanctum; P. nodiflora; S. nux-vomica;* |
| 6 | *Gigaspora albida* | *A. indica; A. paniculata; C. igneus; C. longa; C. zizanioides; G. arborea; H. indicus; P. emblica* |
| 7 | *Gigaspora corolloidea* | *A. bracteata*; *A. vera; C. intibus; E. prostrata; H. auriculata; O. corniculata; R. tetraphylla;* |
| 8 | *Gigaspora gigantea* | *A. marmelos; A. paniculata*; *G. arborea; H. rosa-sinensis; L. elephantum; O, basilicum;'P. amboinicus; P. nodiflora; S. album; S. cumini; T. procumbens; S. trilobatum; T. bellerica; T, chebula; W. somnifera* |
| 9 | *Glomus* sp. | *A. bracteata; A. calamus; A. marmelos; A. paniculata; C. longa; G. sylvestre; H. rosa-sinensis; R tetraphylla; T. procumbens; W. somnifera* |
| 10 | *Glomus aggregatum* | *A. calamus; A. marmelos; A, indica; A. paniculata*; *A, vasica*; *A. vera*; *C. asiatica; C. igneus; E. prostrate; G. arbora; H. rosa-sinensis; K. pinnata; L. elephantum; O, basilicum; O. sanctum; P. amboinicus; P. nodiflora; S. album; S. cumini; T. procumbens; S. trilobatum; T. bellerica; T. chebula; T. cordifolia; W. somnifera* (25 Plants) |
| 11 | *Glomus albidum* | *A. paniculata; O. sanctum; A. album; W. somnifera* |
| 12 | *Glomus caledonicum* | *A. vera; A. paniculata; C. longa; H. indicus; S. procumbens; S. cumini; S. nox-vomica; T. chebula; T. cordifolia; W. somnifera* |
| 13 | *Glomus clarum* | *A. indica; A. vera; C. zizanioides; H. auriculata; O. sanctum; P. amboinicus;S. album; W. somnifera* |
| 14 | *Glomus claroideum* | *A. marmelos; C. asiatica; C. longa; H. rosa-sinensis; K. pinnata; O. basilicum; O. sanctum; S. trilobatum; W. somnifera* |
| 15 | *Glomus deserticola* | *G. arborea; R. tetraphylla*; *S. cumini*; *S. trilobatum*; *T. cordifolia* |
| 16 | *Glomus fasciculatium* | *A. bracteata; A. calamus; A. marmelos; A, indica; A. paniculata*; *A, vasica*; *A. vera*; *C. asiatica; C. igneus; C.* |

| S. No. | AM Fungi | Isolated from rhizosphere of medicinal plants |
|---|---|---|
| | | *longa, C. zizanioides; E. prostrate; G. arborea; H. inidcus, H. rosa-sinensis; K. pinnata; L. elephantum; O, basilicum; O. sanctum; P. amboinicus; P. nodiflora; R. tetraphylla, S. album; S. cumini; T. procumbens; S. trilobatum; T. bellerica; T. chebula; T. cordifolia; W. somnifera* (30 Plants) |
| 17 | *Glomus fecundisporum* | *A. indica; A. vera; C. zizanioides; H. auriculata; O. sanctum; P. amboinicus;S. album; W. somnifera* |
| 18 | *Glomus fulvus* | *A. vasica; L. elephantum; P. amboinicus; P. emblica; R. tetraphylla; S. album; S. cumini;W. somnifera,* |
| 19 | *Glomus geosporum* | *A. calamus; A. marmelos; A, indica; A. paniculata*; *A, vasica*; *A. vera*; *C. asiatica; C. igneus; E. prostrate; G. arbora; H. rosa-sinensis; K. pinnata; L. elephantum; O, basilicum; O. sanctum; P. amboinicus; P. nodiflora; S. album; S. cumini; T. procumbens; S. trilobatum; T. bellerica; T. chebula; T. cordifolia; W. somnifera* (25 Plants) |
| 20 | *Glomus intraradices* | *C. intibus; H. auriculata; K. pinnata; O. basilicum; O. sanctum; P. amboinicus; S. nux-vomica* |
| 21 | *Glomus macrocarpum* | *H. rosa-sinensis; K. pinnata; O. basilicum; O. sanctum; S. trilobatum; W. somnifera, S. procumbens* |
| 22 | *Glomus maculosum* | *A. bracteata; A. indica; G. arborea; G. sylvestre; H. auriculata; O. corniculata;* |
| 23 | *Glomus microcarpum* | *A. calamus; A. indica; K. pinnata; O. basilicum; O. sanctum; P. embilca; P. nodiflora; S. trilobatu; S. album; S. cumini; S. nux-vomica; T. cordifolia;* |

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