Short communication

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# Floristic composition and weed diversity in rice fields

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Rice (*Oryza sativa* L.), the staple food of more than 60% population of the World, plays a crucial role in the economic and social stability of the world. In India, about 33% of rice yield losses caused by weeds (Mukherjee 2004), while in Sri Lanka, weeds accounted for 30 – 40% of yield losses (Abeysekera 2001). In world rice production, about 10% of the total yield is reduced by weeds (Oerke and Dehne 2004). Rice is growing in about 45 million hectares with production of 96 million tonnes contributing 45% to the total food grain production of India. The weeds that flourish along with the rice crops further affect the low agriculture production because of limited area for cultivation. Therefore the present study was undertaken to identify and enlist the weed species in rice fields, The vegetative analysis of weeds in fields, the density and species richness of the weeds, the dominance of weed species / type.

The field experiment was conducted during winter season (November 2010 to April 2011) in the agricultural fields at five different villages *i.e.* Kiliyanur, Konthamur, Thensiruvallur, Thailapuram and Aadhanapattu Village around Vanur taluk – Villupuram district, Tamilnadu. The average annual rainfall is 1119.8 mm with a minimum and maximum average annual temperature of 32.78 °C in May and 24.08 °C in January, respectively. (IMD: India meteorological department). The work was carried out in five different villages in and around Vanur taluk. The soil was silty clay in texture and high in fertility with 7.0-8.2 pH. The rice was broadcasted in early June with the arrival of pre-monsoon at upland site. At lowland site 29 days old seedlings were transplanted in early December on 5 × 5 m sized plots in randomized block design. The observation of weeds in rice field was carried out at 15$^{th}$ and 30 days after transplanting. From the date of rice cultivation to harvest time, weed species were observed for floristic study. For the vegetation analysis of weeds, ten quadrants of 1 × 1 m were placed for density and abundance, per method of Misra (1968). The weeds with higher density and species richness were considered as dominant weeds.

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**Vegetation survey**

A systematic sampling method was carried out to study the weed species in rice fields. Total 10 quadrants from each village were taluk. Hundred number of local people were interviewed for knowing medicinal value of the weeds encountered during survey in rice fields.

After rice harvest, 1 kg soil sample (0 - 30 cm depth) was collected from each plot and were used to find out the soil pH, organic matter content, nitrogen (N), phosphorus (P) and potassium (K). The soil pH was determined by using Fischor's Digital meter as well as pH paper. Organic matter content was determined by Walkey and Black's method (1934). Nitrogen in soil was determined by micro- Kjeldahl method and Olsen's method (1954) was used to determine phosphorus. Potassium was determined by atomic absorption spectrophotometer (Gupta 2000). The experiment for soil texture analysis was conducted based on the procedure given by Piper (1944) (Table 3).

A total of 7609 individual of weeds representing 56 species 45 genera and 23 families were recorded. At site 3 (Thensiruvallur) there was high number of species diversity containing 44 species belonging to 24 families with a total density of 1277 individuals followed by site 2 (Konthamur) comprising 38 species belonging to 21 family with 1479 individuals. At site 1 (Kiliyanur), were 37 species belonging to 18 family with 1930 individuals while at site 5 (Aadhanapattu), 32 species belonging to 17 families and 1753 individuals were recorded. Thailapuram had 30 species, 16 families and 1242 individuals.

Survey recorded maximum 45 species in Thensiruvallur followed by Konthamur (38 species), Kiliyanur (37 species), Aadhanapattu (32 species) and Thailapuram (30 species) villages with a total of 56 species belonging to 23 families distributed in different life forms *i.e.* herbs (40), grasses (8), sedges (4) and ferns (1). Dicot species were more prominent than monocot. Weeds appeared fifteen days after transplantation. *Echinochloa colona* was an abundant weed in the five different rice fields. The differences in weed species numbers and its

composition between the study sites probably indicated how much the crops get affected in the field. The supremacy of monocots over dicots at upland site in present investigation was similar to the findings of Thapa and Jha (2002). The domination of grasses and sedges in the present study was at par with the findings of Thapa and Jha (2002) and Dangol *et al.* (2002). Assessment of the losses due to weed is a difficult work because the extent of damage vary from year to year depending on the crop, weed species, soil condition and the climate (Moody 1982) (Table 1).

Species diversity was unevenly distributed along with the taxonomic groups. The following family of Amaranthaceae (8 species), Poaceae (8 species), Cyperaceae (5 species), Asteraceae (4 species), Malvaceae (4 species), Solanaceae (3 species) were found as leading in the flora out of 23 families. Other families were comparatively less diverse. The present study was at par with the findings of purple nutsedge (*Cyperus rotundus* L.) which is one of the most dominant weeds in many field and vegetable crops due to its unique biological and physiological properties (Rao 1968). (Table 2).

**Soil texture**

The soil texture of all the study sites has showed clayey loam and sandy loam which represented by varying proportion of different particles such as clay, coarse sand, fine sand. The proportion of clay particles is more in all the fields.

**Soil N P K**

The pH of all the soil samples ranged from 7–8.2. It was neutral non acidic or alkaline in condition. The EC was good in all the soil samples, ranged from 0.5 to 1.5. Having estimated the soil nitrogen, it was recorded as low in all the five fields (Table 3). It ranged from 59-63. Nitrogen content was lower because the weed growth changed soil chemistry and reduced soil nutrient content. Weeds can utilize plant nutrients more efficiently than crop plant due to their rapidly spreading and deeply penetrating root system (Jordan and Shanter 1980).

Phosphorus content in the soil was medium in range *i.e.* 8–24%. Soil potassium content was medium in the range from 105 -113. During the *Kharif* season, broad-leaved weeds such as *Monochoria hastata, Ludwigia parviflora, Nymphoides indicum* and *Echinochloa crusgalli* became aggressive in transplanted rice (Mukherjee *et al.* 2008). In transplanted rice, *Echinochloa* spp., *Ischaemum rugosum, Caesulia axillaris, Commelina* spp., *Cyperus* spp., and *Fimbristylis miliaceae* are dominant weeds (Singh *et al.* 2009).

Species diversity was unevenly spread among taxonomic groups. The 23 families recorded, Amaranthaceae (8 species) Poaceae (8 species), Cyperaceae (5 species) Asteraceae (4 species) Euphorbiaceae (4 species) Malvaceae (4 species) Solanaceae (3 species), Portulacaceae, Convolvulaceae and Commelinaceae (each 2 species) domined the family and they constituted together 71% of the total plant species. Other families were comparatively less diverse and 12 families had a single species. But the top four Poaceae had 37.8% of total density followed by Cyperaceae (17.34%), Asteraceae (13.6%), and Marsileaceae (10.46%) contribued nearly 80% of total density at all the five studied sites. Similar results have been reported by Dangol *et al.* (1986) from the rice fields of Rampur, Chitwan, Nepal.

**Species diversity**

In consideration of diversity indices, Simpson index provided better comparison among different study sites as compared to Shannon–Weiner Index. As far as Simpson Index Diversity Index is concerned the plant communities were most diversed at site 1 - Kiliyanur (8.66) had higher value followed by site 4 -Thailapuram (7.28), site 3 -Thensiruvallur (6.82), site 5- Aadhanapattu (6.56), and site 2 - Konthamur, (6.19). On the part of Simpson diversity index, Kiliyanur (2.46) was more diverse followed by Thensiruvallur, Thailapuram was parallel in weed diversity (2.36), followed by Aadhanapattu (2.25) and Konthamur (2.11) (Table 3).

**Medicinal values of weeds**

The medicinal data of five sites were analyzed and from those medicinal weed species, 51% were commonly used by the inhabitants for curing various diseases such as cold, cough, fever, liver complaints, kidney stones, wound healing, diabetes, toothache and other miscellaneous purposes (Table 4).

Out of 56 weed species (Table 1), 29 species (Table 4) were commonly used by the inhabitants in that 48.2% of species were used as a whole plant as a medicinal value followed by 24% of species have the combination root and leaves, 10% of species have the combination of root, bark and seed, 6.8% of species have the combination of leaves and fruits, 3.5% of species have the combination of roots, seeds, bulbous and tubers, respectively.

**Table 1. Distribution of weed species in five different rice field in different villages around Vanur taluk – Villupuram district**

| Species | Family | Village | | | | | Total density |
|---|---|---|---|---|---|---|---|
| | | Kiliya. | Kont. | Then. | Thai. | Aadh. | |
| *Abutilon indicum* | Malvaceae | 1 | 1 | 2 | 0 | 3 | 7 |
| *Acalypha indica* | Euphorbiaceae | 4 | 1 | 3 | 2 | 1 | 11 |
| *Acanthospermum hispidum* | Asteraceae | 0 | 0 | 2 | 0 | 0 | 2 |
| *Achyranthes aspera* | Amaranthaceae | 4 | 3 | 0 | 10 | 9 | 26 |
| *Aerva lananta* | Amaranthaceae | 8 | | 8 | 0 | 0 | 16 |
| *Alternanthera echinata* | Amaranthaceae | 0 | 0 | 2 | 0 | 0 | 2 |
| *Alternanthera sessilis* | Amaranthaceae | 112 | 0 | 0 | 0 | 38 | 150 |
| *Amaranthus spinosus* | Amaranthaceae | 1 | 1 | 2 | 1 | | 5 |
| *Amaranthus viridis* | Amaranthaceae | 0 | 0 | 0 | 3 | 1 | 4 |
| *Ammania baccifera* | Lythraceae | 88 | 116 | 113 | 33 | 82 | 432 |
| *Asteracantha longifolia* | Acanthaceae | 17 | 10 | 12 | 4 | 14 | 57 |
| *Bergia capensis* | Elatinaceae | 146 | 4 | 23 | 102 | 94 | 369 |
| *Brachiaria reptens* | Poaceae | 0 | 1 | 1 | 0 | 0 | 2 |
| *Celosia argentea* | Amaranthaceae | 0 | 1 | 2 | 0 | 0 | 3 |
| *Centella asiatica* | Apiaceae | 1 | | 1 | | 1 | 3 |
| *Chloris barbata* | Poaceae | 22 | 9 | 10 | 11 | 10 | 62 |
| *Cleoma viscosa* | Capparidaceae | 1 | 1 | 1 | | | 3 |
| *Coccinia indica* | Cucurbitaceae | | | 1 | | | 1 |
| *Commelina benghalensis* | Commelinacea | 9 | 4 | 4 | 5 | 5 | 27 |
| *Commelina diffusa* | Commelinaceae | 1 | 1 | 1 | | 1 | 4 |
| *Convolvulus arvensis* | Convolvulaceae | | 1 | 1 | | | 2 |
| *Croton bonplandianum* | Euphorbiaceae | | | | 2 | | 2 |
| *Cynodon dactylon* | Poaceae | 220 | 180 | 124 | 125 | 108 | 757 |
| *Cyperus difformis* | Cyperaceae | 251 | 215 | 147 | 230 | 299 | 1142 |
| *Cyperus iria* | Cyperaceae | 3 | 3 | 14 | 26 | 4 | 50 |
| *Cyperus rotundus* | Cyperaceae | 17 | 4 | 11 | 49 | 43 | 124 |
| *Dactyloctenium aegyptium* | Poaceae | 18 | 4 | 9 | 8 | 6 | 45 |
| *Digera arvensis* | Amaranthaceae | 5 | 2 | 1 | 2 | | 10 |
| *Digitaria sanguinalis* | Poaceae | | 2 | | | 1 | 3 |
| *Echinochloa colonum* | Poaceae | 392 | 394 | 375 | 325 | 484 | 1970 |
| *Echinochloa crusgalli* | Poaceae | 23 | 7 | 14 | 12 | 7 | 63 |
| *Eclipta alba* | Asteraceae | 259 | 289 | 175 | 72 | 234 | 1029 |
| *Eichhornia crassipes* | Pontederiaceae | | 1 | 1 | 2 | | 4 |
| *Eleocharis atropurpurea* | Cyperaceae | | | | 1 | | 1 |
| *Eragrostis pilosa* | Poaceae | | 2 | 1 | | | 5 |
| *Euphorbia hirta* | Euphorbiaceae | 22 | 13 | 8 | 15 | 19 | 77 |
| *Fimbristylis miliacea* | Cyperaceae | 3 | 1 | 7 | 2 | 2 | 15 |
| *Ipomoea carnea* | Convolvulaceae | | 1 | 2 | | | 3 |
| *Ischaemum rugosum* | Poaceae | | 1 | | | 1 | 2 |
| *Leucas aspera* | Lamiaceae | 9 | 3 | 2 | 4 | | 18 |
| *Lippia nodiflora* | Verbenaceae | 26 | 42 | 47 | 59 | 34 | 208 |
| *Ludwigia parviflora* | Onagraceae | 13 | 8 | 5 | 5 | 11 | 42 |
| *Marsilea quadrifoliata* | Marsileaceae | 233 | 147 | 124 | 122 | 178 | 804 |
| *Ocimum canum* | Labiatae | 8 | | 2 | | | 10 |
| *Phyllanthus niruri* | Euphorbiaceae | 4 | 3 | 7 | | 9 | 23 |
| *Physalis minima* | Solanaceae | 1 | 1 | | 1 | 1 | 4 |
| *Physalis peruviana* | Solanaceae | | | 2 | | | 2 |
| *Portulaca meridiana* | Portulacaceae | | 1 | | | | 1 |
| *Portulaca oleracea* | Portulacaceae | | | | 6 | | 6 |
| *Sida acuta* | Malvaceae | | | 1 | | | 1 |
| *Sida cordifolia* | Malvaceae | | 1 | | | | 1 |
| *Sida rhombifolia* | Malvaceae | | | | | 1 | 2 |
| *Solanum nigrum* | Solanaceae | 1 | | 1 | | | 2 |
| *Sphenoclea zeylanica* | Sphenocleaceae | | | | | 48 | 48 |
| *Tridax procumbens* | Asteraceae | 1 | | 7 | 3 | | 11 |
| *Vernonia cinerea* | Asteraceae | 3 | | 1 | | 3 | 7 |

Kiliya- Kiliyanur, Kont – Konthamur, Then- Thensiruvallur, Thai –Thailapuram, Aadh- Aadhanapattu P- species present; A- species absent

**Table 2. Consolidated details of weed diversity in five different sites in vanur taluk**

| Variables | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 |
|---|---|---|---|---|---|
| Species Richness | 37 | 38 | 44 | 30 | 32 |
| Family | 18 | 20 | 22 | 16 | 16 |
| Density | 1930 | 1479 | 1277 | 1242 | 1753 |
| Diversity Index | | | | | |
| Simpson Mean | 8.66 | 6.19 | 6.82 | 7.28 | 6.56 |
| Shannon Mean | 2.46 | 2.11 | 2.36 | 2.36 | 2.25 |
| Fisher's Alpha | 6.49 | 7.11 | 8.58 | 5.54 | 5.17 |

**Table 3. Analysis of soil characteristics in five different soil samples**

| | Site 1 (Kiliya) | Site 2 (Kont) | Site 3 (Then) | Site 4 (Thai) | Site 5 (Aadh) |
|---|---|---|---|---|---|
| *Soil characteristics* | | | | | |
| pH | 7.2 | 7 | 7.1 | 7.2 | 8.2 |
| EC | 0.1 | 0.17 | 0.26 | 0.14 | 0.22 |
| *Physio-chemical properties in soil(kg/acr)* | | | | | |
| N | 60 | 63 | 55 | 59 | 59 |
| P | 24 | 18 | 20 | 8 | 9 |
| K | 105 | 113 | 110 | 113 | 113 |

Kiliya-Kiliyanur, Kont–Konthamur, Then-Thensiruvallur, Thai–Thailapuram, Aadh-Aadhanapattu; EC – Electrical conductivity (m.mhos/cm), N–nitrogen, P- phosphorus, K- potassium

The Floristic composition of weeds in five different rice field around Vanur taluk was studied from November 2010 to April 2011. From the six month observations, it was found that weed growth occured within 41 days after rice sowing and they may propagate by seeds and propagules or by both. A total of 56 weed species belonging to 23 families were identified. Out of this, 37 species in Kiliyanur, 38 species in Konthamur, 45 species in Thensiruvallur, 30 species in Thailapuram and 32 species in Aadhanapattu were identified. An important value index for each weed species was calculated to its dominance. Herbaceous species were dominant in rice field. The weeds of *Bergia capensis, Cynodon dactylon, Cyperus difformis, Eclipta alba, Echinochloa colona, Marsilea quadrifolia* were dominant species. In view of weed species diversity, the rice field at Thensiruvallur village was exceedingly diverse when compared to other fields. The perennial weeds caused the most serious problem in rice fields. Major weeds produce a large number of seeds, which may remain in soil and serve as soil seed bank for the

**Table 4. Medicinal value of weed species present in paddy field**

| Species | Family | Part | Uses |
|---|---|---|---|
| *Abutilon indicum (Linn.)* | Malvaceae | Seed, root, bark, | Hypothermic, analgesic and aphrodisiac |
| *Acalypha indica Linn.* | Euphorbiaceae | Roots, leaves, | Anthelmintic, expectorant, emetic and anodyne |
| *Achyranthes aspera Linn* | Amaranthaceae | Whole plant | Cardiac, stimulant, diuretic, astringent. |
| *Aerva lanata* | Amaranthaceae | stalks, flower | Anthelmintic, diuretic, anti-inflammatory and anti-bacteria |
| *Amaranthus spinosus* | Amaranthaceae | Roots, leaves, | Diuretic, emollient and febrifuge |
| *Amaranthus viridis* | Amaranthaceae | Whole plant | Diuretic and emollient |
| *Centella asiatica* | Apiaceae | Whole plant | It is a tonic, blood |
| *Celosia argentea* | Amaranthaceae | Roots, leaves, | Antibacterial, anti-inflammatory. Aantibacterial, wound and healing. |
| *Commelina benghalensis* | Commelinaceae | Roots, leaves, | It is used for the children for digestion. |
| *Coccinia grandis* | Cucurbitaceae | Bulbous tuber | Hypoglycaemic, antiprotozoa. |
| *Cyperus rotundus* | Cyperaceae | Whole plant | Shoots and tubers are useful as stimulant, vemifuge and stimulates milk secretion. |
| *Cynodon dactylon* | Poaceae | Whole plant | Dysentry |
| *Eclipta alba* | Asteraceae | Leaves, fruit | Useful to cure asthma and other diseases. |
| *Euphorbia hirta* | Euphorbiaceae | Roots, leaves | Diuretic and aphrodisiac |
| *Ipomoea carnea* | Convolvulaceae | Roots, leaves | Aphrodisiac and galactogenic |
| *Ipomoea reptans* | Convolvulaceae | Roots, leaves | Hypoglycemic, diuretic. |
| *Lippia nodiflora* | Verbenaceae | Whole plant | Cold and suppurations |
| *Marsilea quadrifoliata* | Marsileaceae | Whole plant | It is used to treat Snakebites. |
| *Ocimum canum* | Lamiaceae | Whole plant | Diaphoretic and stimulant |
| *Ocimum sanctum* | Lamiaceae | Whole plant | Antidysenteric and stimulant. |
| *Phyllanthus niruri* | Euphorbiaceae | Whole plant | Antibacterial |
| *Physalis minima* | Solanaceae | Leaves, fruit | Diuretic and purgative. |
| *Portulaca oleracea* | Portulacaceae | Whole plant | Anti-inflammatory, Anti-bacteria and Anti-fungal effects |
| *Sida cordifolia* | Malvaceae | Seed, root, bark | Antiparalytic and aphrodisiac |
| *Solanum nigrum* | Solanaceae | Seed, root, bark | Spasmolytic |
| *Sida acuta* | Malvaceae | roots , seeds | Astringent, febrifuge and stomachic |
| *Sida rhombifolia Linn.* | Malvaceae | Whole plant | Anabolic and emollient |
| *Tridax procumbens* | Asteraceae | Whole plant | Anti-inflammatory and Anti-bacterial and Anti-fungal effects |
| *Vernonia cinerea* | Asteraceae | Whole plant | Astringent, diaphoretic, antirheumatic |

next cropping season. The major weeds should be controlled at proper time to check reduction in rice yield, and they must be removed before flowering and fruiting to reduce the production of seeds that remain as soil seed bank.

## SUMMARY

The Floristic composition of weeds in five different rice field around Vanur taluk of Villupuram district, Tamil Nadu, India was studied from November 2010 to April 2011. A total of 56 weed species belonging to 23 families was identified. Out of this 37 species in Kiliyanur, 38 species in Konthamur, 45 species in Thensiruvallur, 30 species in Thailapuram, and 32 species in Aadhanapattu were identified. An important value index for each weeds species was calculated to find dominance. *Bergia capensis, Cynodon dactylon, Cyperus difformis, Eclipta alba, Echinochloa colona, Marsilea quadrifolia* were dominant weeds species. Considering species diversity, Thensiruvallur village rice field was highly diverse of weed species compared to other fields. From the six month observations, it was found that weed growth occurs within forty one days after rice sowing. The perennial weeds created the most serious problem in rice fields.

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