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Weed flora of black pepper garden at high rainfall tract of northern agro-climatic zone of Kerala*

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Black pepper (*Piper nigrum* L.) is a vine trailed on live support trees (standards) planted at a spacing of 2.5 to 3.0 m on either side, however, spacing varies considerably according to local farming situation. Weed is one of the major problems that affect the growth and development of black pepper. Weeds, besides competing with black pepper for natural resources, also harbor diseases and serve as alternative hosts of root-knot nematode and viruses. Field survey has shown that weed flora in black pepper have changed with location/agro-climatic situation (Ipor, 1993; Kueh *et al.*, 1993; Abraham and Abraham, 1998). Weeds are used as mulch in black pepper garden (Parthasarathy *et al.*, 2007). Black pepper being widely spaced crop and grown in high rainfall tropical humid climate that offers great scope for weeds to emerge and compete with crop at different magnitude (Parthasarathy and Kandiannan, 2009). An understanding of the common weeds associated with this crop in different agro-climatic situation is important for plantation management. The objectives of this study were to identify the weed flora and the most predominant weed species present in black pepper plantation and to analyze the major nutrient content of the weed species.

A field survey to identify weeds in black pepper plantation was conducted at Indian Institute of Spices Research (IISR) experimental farm, Peruvannamuzhi, Kozhikode District, Kerala during 2009. The topography of the area consists of a range of undulating hillocks, dissected by numerous valleys.

The altitude ranges from 10 m to 60 m MSL. The farm area falls under high rainfall tract of northern agro-climatic zone of Kerala and enjoys a humid tropical climate. The tract is receiving 4461 mm of annual rainfall in 145 rainy days. South west monsoon (June to September) alone contributes 75% of the annual rainfall and July was the peak rainy month (1117mm) with 27 rainy days. The length of growing period was between 18th to 47th week (30th April to 25th November) (Kandiannan *et al.*, 2008). The temperature ranges from 19°C during February to 37°C in April. The months January to March are comparatively dry. Geologically the area is primarily a zone of residual laterite.

In order to make weed count, a quadrate. with a square of 50 cm was used in this study. Five random samples were observed from ten black pepper plots. The quadrate was randomly thrown into the field, individual weed species inside the quadrate were counted, and the actual number of species per unit area was recorded. While counting the species, care was taken to count the species which fall within the quadrate only. The species which are lying or just overlapping the quadrate but not have sprouted from the sampling unit were omitted. Weeds in quadrate were identified and classified into monocots and dicots. Following weed indices were calculated.

$$\text{Density} = \frac{\text{Total count of individual species}}{\text{Number of samples (quadrates studied) where the species is present}}$$

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$$\text{Frequency (\%)} = \frac{\text{Number of times (quadrates) where particular species occurred}}{\text{Total number of quadrates studied}} \times 100$$

$$\text{Relative density (\%) [RD]} = \frac{\text{Density for a given species}}{\text{Total density for all species}} \times 100$$

$$\text{Relative frequency (\%) [RF]} = \frac{\text{Frequency value for a species}}{\text{Total frequency for all species}} \times 100$$

$$\text{Summed dominance ratio (SDR)} = \frac{RD + RF}{2}$$

The weed samples collected were thoroughly cleaned and kept for drying in the hot air oven at 60°C until uniform dry weight was obtained. These samples used for chemical analysis by standard procedures.

The survey indicated the presence of 51 weed species belonging to 47 genera of 31 families. Among them 3 were monocotyledonous (including 1 sedge), 47 dicotyledonous and 1 terrestrial fern (Pteridophyte) (Table 1). The species which are very common and are found in the pepper fields are mostly herbs. On an average 37 weeds per quadrate with a range of 12 to 101, similarly, mean of 5 species per quadrate (1 monocot and 4 dicot) were noted. Weed species belonging to Asteraceae, Convolvulaceae, Solanaceae and Euphorbiaceae were the most abundant families based on the number of species recorded. Annual weeds were common than perennial weeds. The observed dominant mono-and dicotyledonous species were *Ageratum conyzoides, Vernonia cinerea* L., *Chromolaena odorata* (L.) King & Robins (Asteraceae), *Mollugo stricta* L., *Mollugo pentaphylla* L. (*Molluginaceae*), *Oxalis corniculata* L., *Biophytum sensitivum* (L.) DC. (*Oxalidaceae*),

Table 1. Weed species present in black pepper plantation

Acanthaceae
- *Justicia adhatoda* L.
- *Ruellia prostrata* Poir.

Apocynaceae
- *Rauwolfia serpentina* (L.) Benth.ex Kurz
- *Ichnocarpus frutescens* (L.) R.Br.

Asteraceae
- *Eclipta prostrata* L.
- *Vernonia cinerea* L.
- *Ageratum conyzoides* L.
- *Emilia sonchifolia* (L.) DC.
- *Chromolaena odorata* L.

Caesalpiniaceae
- *Senna sophera* (L.) Roxb.

Capparaceae
- *Cleome rutidosperma* DC.

Convolvulaceae
- *Evolvulus nummularius* (L.) L.
- *Ipomoea digitata* L.
- *Merremia vitifolia*(Burm.f) Hall.f.

Cyperaceae
- *Kyllinga monocephala* Rottb.

Commelinaceae
- *Commelina difffusa* Burm.f.

Euphorbiaceae
- *Euphorbia hirta* L.
- *Phyllanthus amarus* Schum and Thonn.
- *Phyllanthus urinaria* L.

Fabaceae
- *Centrosema molle* Mart.ex Benth.
- *Crotalaria pallida* Aiton.

Lamiaceae
- *Leucas indica* L.

Lobeliaceae
- *Lobelia alsinoides* Lain.

Malvaceae
- *Sida rhombifolia* L.
- *Sida alnifolia* L.

Menispermaceae
- *Cyclea peltata* (Lam.) Hook.f.and Thoms

Mimosaceae
- *Mimosa diplotricha* L.
- *Mimosa pudica* L.

Molluginaceae
- *Mollugo pentaphylla* L.
- *Mollugo stricta* L.

Moraceae
- *Ficus exasperata* Vahl

Nyctaginaceae
- *Boerhaavia diffusa* L.

Oxalidaceae
- *Biophytum sensitivum* (L.) DC.
- *Oxalis corniculata* L.

Piperaceae
- *Peperomia pellucida* (L.) Kunth

Poaceae
- *Cynodon dactylon* (L.) Pers.

Pteridaceae
- *Pteris quadriaurita* Retz.

Rhamnaceae
- *Zizyphus oenopila* (L.) Mill.

Rubiaceae
- *Spermacoce latifolia* Aubl.
- *Oldenlandia auricularia* (L.) F.Muell.

Rutaceae
- *Glycosmis pentaphylla* (Retz.) DC.

Scrophulariaceae
- *Scoparia dulcis* L.

Solanaceae
- *Capsicum frutescens* L.
- *Physalis angulata* L.
- *Solanum torvum* Sw.

Sterculiaceae
- *Helicteres isora* L.
- *Melochia corchorifolia* L.

Tiliaceae
- *Corchorus aestuans* L.

Umbelliferae
- *Centella asiatica* L.

Verbenaceae
- *Lantana camara* L.
- *Stachytarpheta jamaicensis* (L.) Vahl.

Solanum torvum Sw. (Solanaceae), *Phyllanthus amarus* Schum and Thonn., *Phyllanthus urinaria* L., *Euphorbia hirta* L. (Euphorbiaceae), *Sida alnifolia* L., *Sida rhombifolia* L. (Malvaceae), *Mimosa pudica* L., *Mimosa diplotricha* L. (Mimosae), *Spermacoce latifolia* Aubl., *Oldenlandia auricularia* (L.) F.Muell. (Rubiaceae), *Evolvulus nummularius* (L.)L., *Merremia vitifolia* (Burm.f) Hall.f., *Ipomoea digitata* L. (Convolvulaceae), *Stachytarpheta jamaicensis* (L.) Vahl., *Lantana camara* Linn. (Verbenaceae), *Peperomia pellucida* (L.) Kunth, (Piperaceae), *Crotalaria pallida* Aiton, *Centrosema molle* Mart.ex Benth. (Fabaceae). Monocot weeds were less in number and only three monocots were identified, monocot weed species were *Commelina diffusa* Burm.f., *Kyllinga monocephala* Rottb. and *Cynodon dactylon* (L.) Pers (Table 2). *Pteris quadriuarita* Retz. was the terrestrial fern present in the pepper field. Weed flora vary with location, earlier, Anandaraj *et al.* (1989) and Thankamani *et al.* (2000) have reported nine important weeds from this location.

Similar weed surveys in plantation and field crops were undertaken throughout the world by different workers from time to time. For example, weed survey carried out in rubber (*Hevea brasiliensis* Muell. Arg), oil palm (*Elaeis guineensis* Jacq.), cocoa (*Theobroma cacao* L.), tea (*Camellia sinensis* (L.) O.Kunze.) and rice (*Oryza sativa* L.) in Indonesia indicated the presence of 131 weed species from 89 genera and 43 families. It further highlighted that *Euphorbia prunifolia* and *Spermacoce alata* are the dominant weed species in tea and cocoa (Mangoensoekardjo and Pancho, 1975). Another work in tea fields of Taiwan indicated that *Ageratun houstianum* composed 66% of the weed flora (Liau, 1974). This indicates that weed flora vary with location. Weed survey in black pepper fields of India was carried out by Abraham and Abraham (1998) in Cannanore, Wyanad, Idukki and Kozhikode districts of Kerala. Their results indicated the presence of a diversified group of weeds in pepper gardens and recorded 55 weeds (41 dicots, 9 grasses, 3 ferns and 2 sedges). The

Table 2. Weed indices of selective weeds in black pepper garden

Name of weed species	Density	Frequency (%)	Relative density (%)	Relative frequency (%)	SDR
Commelina diffusa Burm.f.	1.22	26.0	36.8	5.3	21.0
Spermacoce latifolia Aubl.	4.34	52.0	55.0	10.6	32.8
Peperomia pellucida (L.) Kunth	7.98	36.0	56.0	7.4	31.6
Ageratum conyzoides L.	8.04	62.0	56.7	12.7	34.7
Corchorus aestuans L.	0.60	12.0	40.0	2.4	21.2
Cynodon dacytlon (L.) Pers.	3.54	62.0	42.8	12.7	27.7
Oldenlandia auricularia (L.) F.Muell.	3.72	42.0	41.6	8.6	25.1
Kyllinga monocephala Rottb.	2.52	28.0	79.3	5.7	42.5
Centrosema molle Mart.ex Benth.	0.44	14.0	32.0	1.6	16.8
Euphorbia hirta L.	0.22	2.0	35.2	2.8	19.0
Phyllanthus urinaria L.	0.32	8.0	37.9	0.4	19.1
Mimosa diplotricha L.	0.24	6.0	38.8	1.2	20.0
Ficus exasperata Vahl.	0.02	2.0	05.2	0.40	2.8
Crotalaria pallida Aiton	0.42	14.0	10.8	2.90	6.8
Mimosa pudica L.	0.24	10.0	07.5	2.0	4.7
Leucas indica L.	0.06	4.0	12.5	0.8	6.6
Cleome rutidosperma DC.	0.46	16.0	17.1	3.2	10.2
Boerhaavia diffusa L.	0.02	2.0	04.0	0.4	2.2
Vernonia cinerea (L.) Less.var.	0.20	8.0	25.0	1.6	13.3
Ichnocarpus frutescens (L.) R.Br.	0.74	34.0	12.0	6.9	9.4
Cyclea peltata (Lam.) Hook.f and Thoms	0.60	22.0	18.4	4.5	11.4
Oxalis corniculata L.	0.58	10.0	08.1	2.0	5.0
Biophytum sensitivum (L.) DC.	0.06	2.0	04.0	0.4	2.2
Phyllanthus amarus Schum andThonn.	0.38	8.00	18.9	1.6	10.2
Rauwolfia serpentina (L.) Benth.ex Kurz.	0.04	2.00	07.7	0.4	4.0
Capsicum frutescens L.	0.02	2.00	03.4	0.4	1.9
Stachytarpheta jamaicensis (L.) Vahl	0.02	2.00	03.4	0.4	1.9

major dicot weeds in their study were *Drymaria cordata* Willd., *Mimosa pudica* L., *Sida rhombifolia* L., *Synedrella nodiflora* Gaeirtn., *Ageratum conyzoides* L., *Bidens pilosa* L., *Mikania micantha* HBK., *Peperomia pellucida* (L.) Kunth. and *Vernonia cinerea* (L.) Less. Most of these weeds are seen in the high altitude regions and are usually associated with plantation crops of hilly areas like cardamom (Sudheesh *et al.*, 1998), coffee and tea (AICRPWC, 1997).

In the present study, *Ageratum conyzoides* L., *Peperomia pellucida* (L.) Kunth, *Spermacoce latifolia* Aubl. and *Oldenlandia auricularia* (L.) F. Muell. were the most densely populated weeds in the black pepper garden with average density of 8.04, 7.98, 4.34 and 3.72, respectively. The mean data showed that *Ageratum conyzoides* L., *Cynodon dactylon* (L.) Pers. and *Spermacoce latifolia* Aubl. were the most frequently occurring weeds in black pepper crop having average frequency of 62%, 62% and 52%, respectively.

Nitrogen content of whole weed species ranged from 1.34% to 3.85% (Table 3). A lower value was recorded in *Oldenlandia auricularia* (L.) F Muell and higher content was recorded in *Chromolaena odorata* L. Phosphorous content (P) range from 0.02% to 0.71%. P content is lower in *Boerhaavia diffusa* Linn. (0.02%) and higher in *Rauwolfia serpentina* (L.) Benth.ex Kurz. (0.71%). In case of potassium, the lowest range was in *Ichnocarpus frutescens* (Linn.) R.Br. (1.3%) and highest range was in *Centrosema molle* Mart.ex Benth. (3.02%). Weeds are ubiquitous and its dynamics, species cycle may vary at temporal and spatial scale. It is essential to document them systematically from time to time to know the biodiversity of farming system and manage them for successful crop production. The present information from this study would give insight on weed flora present in this high rainfall tract of northern agro-climatic zone of Kerala.

Table 3. Summary statistics of weed indices and nutrient content of weed species

Weed Indices/Nutrient	Min	Max	Mean	SD	CV (%)
Density	0.02	08.04	01.4	2.26	164.96
Frequency	2.00	62.00	18.1	18.60	102.93
Relative density (RD)	3.40	79.30	26.3	20.50	78.20
Relative frequency (RF)	0.40	12.70	03.6	03.80	03.60
Summed dominance ratio (SDR)	1.90	42.50	15.0	11.60	77.30
Nitrogen (%)	1.34	3.85	2.48	0.55	22.17
Phosphorus (%)	0.02	0.71	0.21	0.10	47.62
Potassium (%)	1.3	3.02	2.00	0.34	17.0

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References

Abraham, C.T. and Abraham, M. 1998. Weeds of pepper gardens in Kerala. *Spice India* **11**(12): 11-13.

AICRPWC. 1997. *All India Co-ordinated Research Programme on Weed Control Annual Report for 1997.* Kerala Agricultural University, Vellanikkara. 61pp.

Anandaraj, M., Sivaraman, K. and Krishnamoorthy, B. 1989. Effective weed control through weedicides in plantation crops. *Indian Cocoa, Arecanut and Spices J.* **13**(2): 63-64.

Ipor, I.B. 1993. Weed problems in pepper (*Piper nigrum* L.) cultivation in Sarawak. In: *The Pepper Industry: Problems and Prospects.* (Eds.) Ibrahim, M.Y., C.F.J. Bong and I.B. Ipor. Universiti Pertanian Malaysia, Bintulu Campus, Bintulu, Sarawak, Malaysia. pp.206-214.

Kandiannan, K., Thankamani, C.K. and Mathew, P.A. 2008. Analysis of rainfall of the high rainfall tract of northern agro-climatic zone of Kerala. *J. Spices and Aromatic Crops* **17**: 16-20.

Kueh, T. K., Lee, L.L. and Othman, F. 1993. Weeds and Weed Management in Pepper Cultivation. In: *The Pepper Industry : Problems and Prospects.* (Eds.) Ibrahim, M.Y., C.F.J. Bong and I.B. Ipor. Universiti Pertanian Malaysia, Bintulu Campus, Bintulu, Sarawak, Malaysia. pp. 193-205.

Liau, T.L. 1974. The comparative experiments on the preventive effectiveness of 37% Asulox S to the weeds of a tea plantation. *Taiwan Agriculture Q.* **10**: 53-68.

Mangoensoekardjo, S. and Pancho, J.V. 1975. Weed inventory in plantations in north Sumatra. *Biotrop. Newsl.* **12**: 12.

Parthasarathy, V.A., Sasikumar, B., Nair, R.R. and Johnson George, K. 2007. Black Pepper: Botany and Horticulture. *Hort. Rev.* **33**: 173–266.

Parthassarathy, V. A. and Kanddiannan, K. 2009. Weed management in spices crops. In: *Proceedings of National Symposium on Weed Threat to Environment, Biodiversity and Agricultural Productivity*, (Eds.) Varshney, J.G. and Sushilkumar. Indian Society of Weed Science, Jabalpur. pp. 10.

Sudheesh, M.V., Abraham, C.T. and Abraham, M. 1998. Distribution and dominance of weeds in cardamom fields of Kerala. *Spice India* **11**(7): 8-10.

Thankamani, C.K., Srinivasan, V., Anandaraj, M. and Kandiannan, K. 2000. Evaluation of weed management practices in a black pepper garden. In: *Proceedings of the National Seminar on New Perspective in Spices, Medicinal and Aromatic Plants* (Eds.) Korikanthimath, V.S., John Zachariah, T., Nirmal babu, K., Suseela bhai, R. and Kandiannan, K. Indian Society for Spices, Calicut. pp. 215-218.

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