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Weeds phytosociology in *Jatropha* plantation of *Terai* region in West Bengal

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ABSTRACT

Phytosociological association of the weeds in the plantation of *Jatropha curcas* L. was studied in pre-monsoon and monsoon season at Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. In pre-monsoon and monsoon period, 15 and 31 weed species were found, respectively. In both the seasons, the dominant family was Poaceae followed by Compositae, Araceae and Cyperaceae. Among the life forms, herbs were found to be dominant followed by grasses, shrubs and climbers. *Digitaria violascens* (54.32) and *Torenia thouarsii* (3.29) had the highest and lowest IVI, respectively, in pre–monsoon period, while *Oplismenus burmani* (68.63) and *Cyperus rotundus* (1.49) recorded maximum and minimum IVI, respectively, in monsoon period. Highest and lowest abundance frequency (A/F) ratio was found with *Ludwigia octavolvis* (0.75) and *Kyllinga bulbosa*, respectively, in pre–monsoon period and *Cyperus rotundus* (0.03); and *Axonopus compressus* (1.05) and *Mikania micrantha* (0.05), respectively, in monsoon period.

The energy scenario of India is based on the both renewable and non-renewable sources of energy *etc*. As per Bharat Petroleum Statistical Review of world Energy (2008), the coal is the highest (51%) contributor of the energy in India followed by oil (32%). To prevent the bad effects of oil imports in relation to economic growth, biofuels are gaining momentum for development (Subramanian *et al*. 2005) due to their economic and social benefits through rural employment and increase in per capita income (Goswami *et al*. 2011). However, the shortage of raw material with high proportion of oil content is one of the major concerns for production of biodiesel (Wani *et al*. 2006). In this context, *Jatropha* as renewable source of production of biofuel hold immense potential for fulfilling the demand of India's future energy needs.

Weeds interfere with the growth of desirable plants which are harmful and persistent hence they are regarded as undesirable. The present study was done to see the association and phytosociological study of weed species that grows in the Jatropha (*Jatropha curcas*) plantation site. *Jatropha* commonly known as 'Physic nut', is a bio-fuel which is of great concern these days as it can meet the increasing demand of energy. Among many factors, weeds too can limit the yield of this biofuel. This crop is highly sensitive to competition with weed species (Concenco *et al*. 2014). It is usually a monocrop and its interrows are usually kept clear during the growing season and this leads to higher weed infestation. This study was aimed at identifying the species that have greater infestation in *Jatropha* plantation, which will help to manage the weeds.

The study was carried out at the *Jatropha* plantation at Uttar Banga Krishi Viswavidyalaya located at Pundibari, Cooch Behar, West Bengal situated between N26^{0}24'16.9" latitudes and E 89^{0}23'11.9" longitudes and at the elevation of 34 msl. The field study was conducted in pre-monsoon and monsoon period of 2013-2014. The climate of the area is sub-topical humid in nature. There was a considerable variation in the seasonal and diurnal temperature of the experimental site. The average minimum and maximum temperature varied from 7.32 ^{0}C during winter (January) to 33.23 ^{0}C during summer (August). Annual rainfall varied from 2000 – 2500 mm, bulk of which being received during the pre-monsoon and monsoon *i.e*. May to September. Relative humidity of the experimental site varied from 56% to 92%.

The size and number of quadrates were determined by species area curve method (Misra 1968). Total 15 quadrates of size 1 x 1 m for each season were laid randomly in the field. The weed species were then collected from each quadrate for further study. After the collection of weeds from the field, the specimens were identified from Flora of British India (Hooker, 1875 -1897), online data base

Table 1. Family and habit of the weed species in *Jatropha* plantation

Plant Species	Family	Habit
Colocasia esculenta (L.) Schott	Araceae	Herb
Cynodon dactylon (L.) Pers.	Poaceae	Grass
Typhonium trilobatum Schott	Araceae	Herb
Eleutheranthera rudielis (Sw.) Sch.Bip.	Compositae	Herb
Kyllinga bulbosa P.Beauv.	Cyperaceae	Herb
Digitaria violascens Link	Poaceae	Grass
Commelina benghalensis L.	Commelinaceae	Herb
Mimosa pudica L.	Leguminosae	Herb
Ludwigia octavolvis (Jacq.) P.H.Raven	Onagraceae	Herb
Ageratum conyzoides (L.) L.	Compositae	Herb
Oplismenus burmani (Retz.) P.Beauv.	Poaceae	Grass
Mikania micrantha Kunth	Compositae	Climber
Axonopus compressus (Sw.) P.Beauv.	Poaceae	Grass
Sida acuta Burm.f.	Malvaceae	Herb
Ceratopteris thalictriodes (L.) Brongn.	Pteridaceae	Herb
Cyperus rotundus L.	Cyperaceae	Herb
Eragrostis tenella (L.) P.Beauv. ex Roem. & Schult.	Poaceae	Grass
Clerodendrum viscosum Vent.	Lamiaceae	Shrub
Pouzolzia indica Gaudich.	Urticaceae	Herb
Acmella calva (DC.) R.K.Jansen	Compositae	Herb
Pupalia atropurpurea (Lam.) Moq.	Amaranthaceae	Herb
Eleusine indica (L.) Gaertn.	Poaceae	Grass
Euphorbia hirta L.	Euphorbiaceae	Herb
Polycarpon prostatum (Forssk.) Asch. & Schweinf.	Caryophyllaceae	Herb
Phyllanthus urinaria L.	Phyllanthaceae	Herb
Eragrostis unioloides (Retz.)	Poaceae	Grass
Dactyloctenium aegyptium (L.) Willd.	Poaceae	Grass
Torenia thouarsii (Cham. & Schltdl.) Kuntze	Linderniaceae	Herb
Setaria viridis (L.) P.Beauv.	Poaceae	Grass
Urena lobata L.	Malvaceae	Herb
Oxalis corniculata L.	Oxalidaceae	Herb

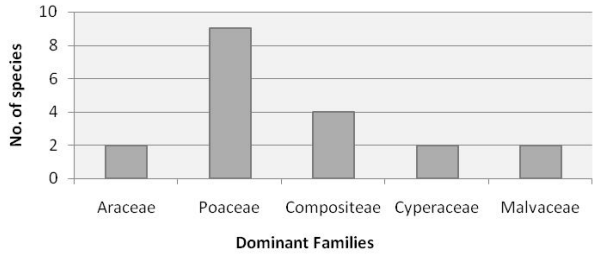

Figure 1. Dominant families among the weed species in the jatropha plantation site

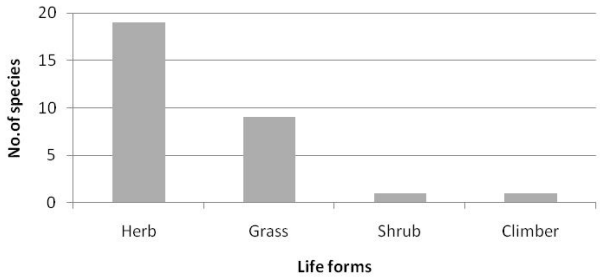

Figure 2. Life forms of the weed species in the jatropha plantation site

www.theplantlist.org on from university. Importance value index (IVI), relative frequency (RF), relative density (RD) and relative abundance (RA) of plant species were calculated according to the formula given by Curtis and McIntosh (1950). The spatial distribution of weed species was determined as per the method outlined by Whitford (1949).

Phytosociological analysis of weeds

Total 31 species occurred in monsoon and 15 species occurred in pre-monsoon season and 31 in monsoon season (**Table 1** and **3**). Large numbers of species were grasses belonging to the family Poaceae (9) followed by Compositae (4), Araceae (2), Cyperaceae (2) and Malvaceae (2) (**Figure 1**). Among the life forms, herbs were more in number followed by grasses, shrubs and climbers (**Figure 2**). Climbers and shrubs were not found in the pre-monsoon period.

The phytosociological survey showed that out of the total plant species, only four species, *viz. Digitaria violascens*, *Cynodon dactylon*, *Oplismenus burmani* and *Ageratum conyzoides* were most dominant species. Dominant species based on importance value (IV) during pre–monsoon was *Digitaria violascens* (54.32) followed by *Oplismenus burmani* (52.91) whereas *Torenia thouarsii* (3.29) showed lower dominance (**Table 2**). During the monsoon period the highest dominance was observed in *Oplismenus burmani* (68.63) followed by *Ageratum conyzoides* (42.54) and the lowest in *Cyperus rotundus* (1.49) (**Table 3**). High importance value (IV) of a species indicates its dominance and ecological success with the power of regeneration, tolerance ability and survivability. It varied with season. It is observed that maximum species grow together in both seasons because similar environment (light, temperature, water and nutrients) requirement for their adaptability. Similar observations were made by Shameem *et al*. (2010). High IVI value was observed by few species because of the most

Table 2. Phytosociological analysis of weeds occurrence during pre- monsoon in the *Jatropha* plantation

Species	RF	RD	RA	IVI	A/F ratio
Typhonium trilobatum Schott	10.53	3.55	3.39	17.47	0.08
Digitaria violascens Link	10.53	22.40	21.39	54.32	0.51
Axonopus compressus (Sw.) P.Beauv	10.53	2.73	2.61	15.87	0.06
Kyllinga bulbosa P.Beauv.	5.26	0.27	0.52	6.06	0.03
Oplismenus burmani (Retz.) P.Beauv	13.16	22.54	17.21	52.91	0.33
Cynodon dactylon (L.) Pers.	13.16	13.11	10.02	36.29	0.19
Ludwigia octavolvis (Jacq.) P.H.Raven	2.63	2.05	7.82	12.51	0.75
Eleusine indica (L.) Gaertn.	7.89	6.69	8.52	23.11	0.27
Cyperus rotundus L.	5.26	0.27	0.52	6.06	0.03
Commelina benghalensis L.	7.89	1.50	1.91	11.31	0.06
Acmella calva (DC.) R.K.Jansen	2.63	0.27	1.04	3.95	0.10
Torenia thouarsii (Cham. & Schltdl.) Kuntze	2.63	0.14	0.52	3.29	0.05
Oxalis corniculata L.	2.63	0.41	1.56	4.61	0.15
Ageratum conyzoides (L.) L.	2.63	0.41	1.56	4.61	0.15
Setaria viridis (L.) P.Beauv.	2.63	1.09	4.17	7.90	0.40

Table 3. Phytosociological analysis of weeds occurrence during monsoon in the *Jatropha* plantation

Species	RF	RD	RA	IVI	A/F ratio
Colocasia esculenta (L.) Schott	1.81	0.56	1.19	3.57	0.19
Cynodon dactylon (L.) Pers.	4.53	13.79	11.62	29.93	0.73
Typhonium trilobatum Schott	1.81	0.45	0.95	3.22	0.15
Eleutheranthera rudielis (Sw.) Sch.Bip.	3.62	0.90	0.95	5.48	0.08
Kyllinga bulbosa P.Beauv.	8.15	8.47	3.97	20.59	0.14
Digitaria violascens Link	11.77	13.22	4.29	29.28	0.10
Commelina benghalensis L.	9.05	11.19	4.71	24.95	0.15
Mimosa pudica L.	2.72	1.02	1.43	5.16	0.15
Ludwigia octavolvis (Jacq.) P.H.Raven	3.62	3.95	4.17	11.74	0.33
Ageratum conyzoides (L.) L.	6.34	22.60	13.61	42.54	0.61
Oplismenus burmani (Retz.) P.Beauv.	11.77	42.94	13.92	68.63	0.34
Mikania micrantha Kunth	4.53	0.90	0.76	6.19	0.05
Axonopus compressus (Sw.) P.Beauv.	1.81	3.16	6.67	11.64	1.05
Sida acuta Burm.f.	2.72	0.45	0.63	3.80	0.07
Ceratopteris thalictriodes (L.) Brongn.	2.72	1.36	1.90	5.98	0.20
Cyperus rotundus L.	0.91	0.11	0.48	1.49	0.15
Eragrostis tenella (L.) P.Beauv. ex Roem. & Schult.	1.81	0.56	1.19	3.57	0.19
Clerodendrum viscosum Vent.	0.91	0.23	0.95	2.08	0.30
Pouzolzia indica Gaudich.	3.62	1.02	1.07	5.71	0.08
Acmella calva (DC.) R.K.Jansen	3.62	1.69	1.79	7.10	0.14
Pupalia atropurpurea (Lam.) Moq.	0.91	0.11	0.48	1.49	0.15
Eleusine indica (L.) Gaertn.	1.81	0.45	0.95	3.22	0.15
Euphorbia hirta L.	3.62	0.90	0.95	5.48	0.08
Polycarpon prostatum (Forssk.) Asch. & Schweinf.	0.91	0.68	2.86	4.44	0.90
Phyllanthus urinaria L.	0.91	0.11	0.48	1.49	0.15
Eragrostis unioloides (Retz.)	1.81	0.45	0.95	3.22	0.15
Dactyloctenium aegyptium (L.) Willd.	0.91	0.23	0.95	2.08	0.30
Torenia thouarsii (Cham. & Schltdl.) Kuntze	2.72	1.58	2.22	6.52	0.23
Setaria viridis (L.) P.Beauv.	1.81	0.34	0.71	2.86	0.11
Urena lobata L.	3.62	0.90	0.95	5.48	0.08
Oxalis corniculata L.	1.81	0.56	1.19	3.57	0.19

RF- Relative frequency, RD- Relative density, RA- Relative abundance, IVI- Importance value index, A/F-ratio of abundance and frequency

available resources utilized by that species and left over are being trapped by the other species as competitors or as associates. This might be due to the sprouting of root stock or seed stock is diminished due to the adverse climatic factors. It is generally argued that each individual species require some set of other species for their existence and they have co-evolved in the ecosystem on which they depend (Paine 1966).

Highest abundance frequency (A/F) ratio in pre–monsoon period was found with *Ludwigia octavolvis* (0.75) and lowest was recorded by both *Kyllinga bulbosa* and *Cyperus rotundus* (0.03) (**Table 2**). In monsoon period, the abundance frequency ratio was highest and lowest with *Axonopus compressus* (1.05) and *Mikania micrantha* (0.05), respectively (Table 3). A seasonal picture of the most of species showed contagious pattern of distribution as the abundance frequency (A/F) ratio of each weed species was > 0.05, except *Kyllinga bulbosa* and *Cyperus rotundus* which showed random pattern of distribution in pre-monsoon season. The pattern of distribution depend both on physic-chemical natures of the environment as well as on the biological characters of the organisms. The contagious pattern of distribution of species indicates natural vegetation (Venna *et al*. 1999). It was evidenced that the area was with natural vegetation in which most seedlings were adapted to grow close to the mother plant as also observed by Njoh *et al*. (2013), Generally weed competition causes low productivity of crops and therefore it become pertinent to protect the crops from the weed infestation. The results of present investigation have significance in effective weed management in *Jatropha* plantation.

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