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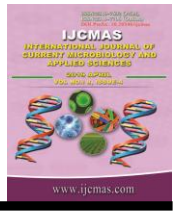

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Weed Dynamics in Rejuvenated Robusta Coffee Plantation of Jorhat District of Assam, India

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A B S T R A C T

Weed problems are very complex and serious in coffee plantations of North East Region of India because of favourable agro climatic situations for weed growth. The study on emergence and population dynamics of weeds will help to develop efficient weed management strategy. Therefore, the present investigation was undertaken for two consecutive years in 2016 and 2017 at the Experimental Garden for Plantation Crops of Assam Agricultural University, Jorhat, Assam with the objective to study the weed dynamics in rejuvenated robusa coffee. In soil seed bank study, the weed emergence was recorded in decreasing order of *Borreria articularis, Sporobolus sp, Ageratum hostonianu, Isachne globosa, Mikania micrantha, Polygonum sp, Diplezium esculentum* and *Digitaria setigera.* The weeds present in rejuvenated coffee consisted of two species of grasses, one species of sedge and six species of broad leaf weeds. Among the grassy weeds, *Isachne globosa* and *Sporobolus* sp. were the dominant ones. The only sedge present was *Cyperus iria*. The predominant among broad leaf weeds were *Mikania micrantha, Gynura bicolor, Spermacoce hispida and Scoparia dulcis*. The weed dynamics revealed the peak density of grass, sedge and broad leaf weed at 80, 120 and 80-160 days after manual weeding and thereafter showed a decreasing trend.

Introduction

Coffee is one of the most important plantation crops of India. In North East India, coffee cultivation is confined in the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura covering 8012 ha providing benefit to more than 11,000 families (Anonymous, 2018). The North East Region of India is a biological hotspot and harbours exceptional biodiversity and has relatively complex biogeography. In this region, weed problems are very complex and serious in coffee plantations because of favourable agro climatic situations for weed growth. A number of weed associations compete with coffee from seedling to harvesting stage for water, light and mineral nutrients. In rejuvenated coffee plantations, weeds are a serious problem particularly during the first three years till the canopy of the coffee plant develops. Weed hinders

growth of rejuvenated coffee plants and may cause mortality. Free growth of weeds reduced the yield of coffee by over 50% in Kenya (Nyabundi and Kimemia, 1998).

The weed succession and distribution patterns in coffee estate are dynamic in nature. Composition of the weed flora may differ depending on location (Hussain *et al.,* 2008). The study of emergence behaviour and population dynamics of weeds will generates useful information to develop efficient weed management strategy. (Deka *et al.,* 2016)

However, information on the emergence, composition, abundance, and dynamics of weed species in rejuvenated robusta coffee plantations of North East Region of India is lacking. Keeping in view the above facts, the present investigation was undertaken at Assam Agricultural University, Jorhat with the objective to study the emergence, dynamics and the changes in dominance spectrum of weeds in rejuvenated robusta coffee.

Materials and Methods

Soil seed bank study was conducted at the Department of Agronomy, AAU, Jorhat. From the rejuvenated coffee plot of the Experimental Garden for Plantation Crops, AAU, Jorhat soil samples were collected up to a depth of 10 cm during the month of February, 2017 and bulked. From the bulked sample 3 sub sample were prepared. These soils were spread at a depth of 10 cm on thermocol trays of size 40 cm x 30 cm. Holes were made on the bottom of the trays for draining of excess water. The trays were kept in net house to prevent contamination from air borne seeds. Tap water, free of weed seed contamination, was regularly sprinkled to keep the soil of the trays moist. All the emerged weeds were allowed to grow to four leaf stages and after counting the population of the recognised weed species, respective plants were eradicated from the trays. The data recording followed by eradication of the weeds at the recognisable state were continued for the entire year as the season bound weed species emerged at different times. However, no chemical was sprayed to break the dormancy of soil borne seeds. The data was recorded from May 2017 to January 2018.

After receipt of pre-monsoon shower during the month of April, manual weeding was carried out and FYM was applied to the experimental plot. To record the composition, abundance, and dynamics, the weed population was counted individually from the rejuvenated coffee plot in 2016 and 2017 (From 15th May to 22th October) at 40 days interval using a quadrate of 50 cm x 50 cm size and expressed as numbers per one square meter size. The total weed population, the population of dominated weeds was observed critically.

Results and Discussion

Weed seed bank study

A total of 11 numbers of weeds were recorded to emerge from the seed bank of rejuvenated coffee soil (Table 1).

Weed flora

The *M. micrantha* associated weeds in rejuvenated coffee consisted of two species of grasses, one species of sedge and five species of broad leaf weeds (Table 2). Among the grassy weeds, *Isachne globosa* (Thunb.) Kuntze and *Sporobolus sp.* were the dominant ones. The only sedge present was *Cyperus iria* L. The predominant among broad leaf weeds were *Gynura bicolor (*Roxb. *ex.* Willd.*)* DC, *Spermacoce hispida* L. and *Scoparia dulcis* L.

Table.1 Soil weed seed bank study of rejuvenated coffee eco system

Name of the weed	Weed emergence from 40 cm x 30cm x 10 cm (12000 cm^3) soil			
	May, 2017	Sep, 2017	Jan, 2018	Total
Spermacoce hispida L.	68.7	12.3	3.0	84.0
Sporobolus sp.	3.6	12.2	1.7	17.5
Ageratum houstonianum **(Mill)**	0	6.7	1.7	8.4
Isachne globosa **(Thunb.) Kuntze**	0	2.7	5.3	8.0
Mikania micrantha **H.B.K.**	3.7	2.3	1.0	6.0
Scoparia dulcis **L**	0	1.3	0	1.3
Melastoma malabathricum L.	0	0.3	0.3	0.6
Alternanthera sessilis **(L.) R. Br.ex DC.**	0	0.3	0	0.3
Polygonum sp	0	1.0	2.3	3.3
Impatiens balsamina **(L.)**	0	0.7	0	0.7
Diplezium esculentum **(Retz.) Sw**	0	0	2.3	2.3
Digitaria setigera **Roth**	0.7	0.7	0	1.4
Cyperus rotandus **(L.)**	0.3	0	0	0.3

Table.2 *M. micrantha* associated weed in rejuvenated coffee at AAU, Jorhat

Botanical name	Family	Habit	Common name	Vernacular name (Assamese)
A. Grass weeds				
Isachne globosa (Thunb.) Kuntze*	Poaceae	P	Swamp millet	Horu bahpotia
Sporobolus sp.*	Poaceae	P	Smut grass	Topaholi
B. Sedge weeds				
Cyperus iria **L.**	Cyperaceae	A	Yellow nut sedge	Murphula bon
C. Broad leaved weeds				
Merremia umbellate **L. Hallier f.**	Convolvulaceae	P	Hogvine	Kalia lata
Mikania micrantha **(HBK)***	Asteraceae	P	Bitter vine	Japani lota
Gynura bicolor **(Roxb.** ***ex*** **. Willd.) DC***	Asteraceae	A	Velvet plant	Kopahibon
Spermacoce hispida **L.***	Rubiaceae	A	Button weed	Gahoribon
Scoparia dulcis **L.***	Scrophulariaceae	A	Broom weed	Bondhonia
Mimosa pudica L.	Mimosaceae	A	Touch-me-not	Nilajibon

* Dominant species, A- Annual, P- Perennial

Table.3 Population dynamics of different weeds (Nos. m-2) in rejuvenated coffee at different days after manual weeding

Botanical name	40 DAMW	80 DAMW	120 DAMW	160 DAMW
2016				
***Isachne globosa* (Thunb.) Kuntze**	17.35	56.38	35.67	9.60
***Sporobolus* sp**	2.25	6.67	5.05	3.80
***Cyperus iria* L.**	1.36	3.67	5.26	4.33
***Merremia umbellate* L. Hallier f.**	1.25	1.65	3.04	1.14
***Mikania micrantha* (HBK)**	3.0	6.15	5.67	4.00
Gynura bicolor (Roxb. ex . Willd.) DC	2.38	5.50	7.46	8.00
***Spermacoce hispida* L.**	2.76	4.45	18.38	13.76
***Scoparia dulcis* L.**	0	3.30	5.14	8.33
***Mimosa pudica* L.**	0	3.68	6.00	3.33
2017				
***Isachne globosa* (Thunb.) Kuntze**	4.37	65.2	43.06	7.81
***Sporobolus* sp**	0.26	5.45	4.3	2.06
***Cyperus iria* L.**	1.00	2.82	4.50	2.60
***Merremia umbellate* L. Hallier f.**	0.09	0.74	2.30	0.85
***Mikania micrantha* (HBK)**	3.67	5.68	5.33	4.68
Gynura bicolor (Roxb. ex . Willd.) DC	0.72	2.59	6.29	9.07
***Spermacoce hispida* L.**	0	4.06	13.14	24.60
***Scoparia dulcis* L.**	0	0.93	7.84	15.20
***Mimosa pudica* L.**	0	2.14	6.40	2.96

Note: days after manual weeding

Weed dynamics

The data (Table 3) during 2016 and 2017 revealed that the density of grass weeds increased from 40 days after weeding up to 80 days after weeding and thereafter it decreased up to 160 days after weeding. The sedge density increased from 40 days after weeding up to 120 days after weeding and thereafter it decreased up to 160 days after weeding. In case of different broadleaf weeds, density increased from 40 days after weeding or 80 days after weeding and reached peak at 80 or 120 or 160 days after weeding and thereafter decreased.

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