Short communication

Indian Journal of Weed Science **47**(1): 103–105, 2015

Density, survival and seed production potential of important weeds of lateritic belt of West Bengal

D.C. Mondal* and A. Hossain

Visva Bharati, Sriniketan, Birbhum, West Bengal 731 236

Received: 3 January 2015; Revised: 8 March 2015

Key words: Cropping system, Density, Seed rain, Survival

Knowledge of weed flora, population and distribution is prerequisite to formulate economic and effective weed management strategy. Composition and density of weed infestation in crops can be predicted from the composition of soil seed bank. Composition of soil seed bank depends on the seed production potential of the weeds and their seed shattering. Each and every flowering plant completes its lifecycle producing seeds for maintaining its generation. These seeds become deposited in the soil after shattering and enrich the soil seed bank year after year. Weeds emerge in huge numbers at the initial growth stage of crop and decrease in number at harvest due to inter - or intra - specific competition and crop management practices. There is insufficient recorded information on seed production potential of important weeds in crop fields of lateritic belt of West Bengal. However, some information on weeds is available in terms of taxonomical aspects (Mukhopadhyay 1968, De and Mukhopadhyay 1984). The current study, therefore, was carried out to have an idea about the density of important weeds at initial growth stage of crop, their survival per cent (%) and seed production potential at harvest under different cropping systems.

The study was conducted at the districts Bankura (22°36.86 - 23°39.21 N latitude and 86° 36.66' - 87° 46.25' E longitude), Western and North–Western part of Birbhum (23° 35.29' - 24° 10.58' N latitude and 87° 5.00' - 87° 37.50' E longitude) and Western part of Burdwan (23° 14.58' - 23° 56.25' N latitude and 86° 45.09'- 87° 37.25' E longitude) representing lateritic belt of West Bengal during *Rabi*, pre-*Kharif* and *Kharif* seasons of 2011-12 and 2012-13. The climate was sub-topical and semi-arid with hot dry summer and short bracing winter. The annual rainfall was 1300–1350 mm most of which is received during June to October. The soil was light textured, porous, slightly acidic and low in organic matter.

***Corresponding author**: dcmondaldwsr@gmail.com

Major cropping systems followed were rice – rice, rice – wheat/mustard/vegetables, rice – potato – sesame/vegetables. Weed management practices followed were two hand weeding or herbicide and one hand weeding in rice; hoeing and weeding in mustard, wheat, vegetables and sesame.

Weed count was done twice by least count quadrate method suggested by Misra (1968) and Raju (1997) using 1 x 1 m quadrate in 10 sampling units (quadrates) for each crop. First count was taken at 20 – 25 days after sowing/transplanting of the crop before taking any weed management measure for documenting the density (no./m^2) of important species. Second count was taken at harvest of crop for documenting weed survival (%) and extent of production of seeds by them. Weeds of large, medium and small sizes were collected randomly in 1 m^2 quadrate in each crop. Average number of plants/ m^2, fruits/plant, seeds/fruit and total number of seeds produced/plant were calculated by usual method and ultimately seed rain (number of seeds deposited/m^2 area) of important species was computed.

Weeds and crops

A total of 24 weed species under 22 genera and 14 families were studied under different cropping systems in relation to their initial population (density), survival per cent and seed rain at harvest of crops (rice, wheat, mustard, sesame, tomato, brinjal, cabbage, cauliflower and pumpkin).

Weed density

At early growth stage of *Kharif* rice when soil remains moist, the weed density was recorded highest in *Mollugo stricta* and lowest in *Commelina nudiflora* under rice – rice cropping system. In rice, under rice – wheat/mustard/vegetables cropping system, highest and lowest density were recorded in *Oldenlandia corymbosa* and *Phylanthus fraternus*, respectively. A density of 10 – 20 weeds/m^2 was recorded under 9 species and 5 – 9 weeds/m^2 under 12 species. In winter and pre-*Kharif* seasons,

maximum and minimum densities were recorded in *Digitaria sanguinalis* and *Echinochloa colona,* respectively in most of the crops.

Weed survival at harvest of crop

In *Commelina nudiflora,* 100 % survival was recorded in rice under rice – rice cropping system. Considering all the crops and cropping systems, survival per cent was recorded 80 – 89% in *Portulaca oleracea, Cyanotis axillaris, Setaria glauca* and *Echinochloa glabrescens.* Sixty to seventy nine per cent survival was recorded in 9 species, 40 – 59% in 6 species and below 40% in 4 species. Higher survival per cent was noticed in somewhat succulent weeds like *Portulaca oleracea, Cyanotis axillaris, Commelina nudiflora*. Same species in different crops and cropping systems differed in its survival percent.

Fruits, heads and spikelets

In grassy weeds (*Digitaria sanguinaslis, Echinochloa colona, Echinochloa glabrescens, Dactyloctenium aegyptium* and *Setaria glauca*) number of spikelets varied from 58 to 1295, *Echinochloa glabrescens* having highest and *Echinochloa colona* the lowest. Two sedges (*Cyperus iria* and *Fimbristylis miliacea*) possessed 988 and 394 spikelets/plant, respectively. Among 17 broad-leaved weeds, number of fruits/plant varied from 5 to 515, *Chenopodium album* possessed highest and *Cyanotis axillaris* the lowest. Two weed species (*Ageratum conyzoides* and *Eclipta prostrata*) under Asteraceae possessed an average of 32 and 7 heads/ plant, respectively.

Table 1. Density, survival and seed rain of dominant species under lateritic belt of West Bengal

Weed species	Family	Crop	Cropping system	Density (no./m^2)		Survival (%)	Seed rain (no./m^2
				Initial	At harvest		
Cyperus iria	*Cyperaceae*	Rice	Rice – rice	16	7	44	2758
Fimbristylis miliacea				9	4	44	3952
Digitaria sanguinalis	*Poaceae*	Rice	Rice – wheat / mustard / vegetables	11	4	36	504
		Wheat		19	7	37	882
		Sesame	Rice – potato – sesame / vegetables	13	9	69	945
Dactyloctenium aegyptium	*Poaceae*	Rice	Rice – wheat / mustard / vegetables	9	7	78	1127
		Tomato (vegetables)		14	11	79	2464
Echinochloa colona	*Poaceae*	Rice	Rice – rice	6	4	67	1096
		Brinjal (vegetables)	Rice – wheat / mustard / vegetables	5	3	60	174
Echinochloa glabrescens	*Poaceae*	Rice	Rice – rice	9	8	89	10360
Setaria glauca	*Poaceae*	Rice	Rice – wheat / mustard / vegetables	14	12	86	2880
Ageratum conyzoides	*Asteraceae*	Rice	Rice – wheat / mustard / vegetables	6	2	33	3520
Anagallis arvensis	*Primulaceae*	Wheat	Rice – wheat / mustard / vegetables	7	4	57	896
Chenopodium album	*Chenopodiaceae*	Mustard	Rice – wheat / mustard / vegetables	9	7	78	3605
Commelina nudiflora	*Commelinaceae*	Rice	Rice – rice	3	3	100	54
Corton bonplandianum	*Euphorbiaceae*	Sesame	Rice – potato – sesame / vegetables	8	4	50	240
Cynotis axillaris	*Commelinaceae*	Rice	Rice -wheat / mustard / vegetables	12	10	83	150
Eclipta prostrata	*Asteraceae*	Rice	Rice - rice	6	4	67	416
		Mustard	Rice – wheat / mustard / vegetables	9	6	67	1260
		Cauliflower (vegetables)	Rice – wheat / mustard / vegetables	5	3	60	216
		Sesame	Rice – potato – sesame / vegetables	8	6	75	960
Euphorbia hirta	*Euphorbiaceae*	Sesame	Rice – potato – sesame / vegetables	12	4	33	780
Melochia corchorifolia	*Sterculiaceae*	Rice	Rice – wheat / mustard / vegetables	8	6	75	840
Mollugo stricta	*Molluginaceae*	Rice	Rice – rice	32	21	66	2436
Oldenlandia corymbosa	*Rubiaceae*	Rice	Rice – wheat / mustard / vegetables	17	7	41	3038
Phyllanthus fraternus	*Euphorbiaceae*	Rice	Rice–wheat / mustard / vegetables	5	3	60	369
Phyllanthus simplex				6	4	67	204
Portulaca oleracea	*Portulacaceae*	Cabbage (vegetables)	Rice – wheat / mustard / vegetables	15	12	80	1824
Solanum nigrum	*Solanaceae*			9	2	22	9176
Spergula arvensis	*Caryophyllaceae*	Mustard	Rice – wheat / mustard / vegetables	18	5	28	40180
Trianthema portulacastrum	*Aizoaceae*	Sesame	Rice – potato – sesame / vegetables	7	4	57	1404
		Pumpkin (vegetables)	Rice – wheat / mustard / vegetables	6	3	50	1008

Seeds

Average number of seeds/fruit varied from 2-74, *Solanum nigram* being highest and *Oldenlandia corymbosa* the lowest. Number of seeds/fruit was recorded 3 in six species, 4 in two species, 8 in two species, 9 in one species, 14 in one species and 28 in one species. Among the weed species under Asteraceae, *Eclipta prostrata* possessed 24 –32 seeds /head depending on the crops and cropping system. *Ageratum conyzoides* possessed 55 seeds/head.

Seed rain

Considering all the crops and cropping systems, highest seed rain was recorded in *Spergula arvensis* followed by *Echinochloa glabrescens, Solanum nigrum, Fimbristylis miliacea, Chenopodium album, Ageratum conyzoides.* Lowest seed rain was recorded in *Commelina nudiflora.* Extent of seed rain differed in the same species *e.g.*, it was higher in *Digitaria* in wheat under rice – wheat/mustard/vegetables as well as in sesame under rice – potato – sesame cropping system than that in rice under rice – wheat/ mustard/ vegetables cropping system. Similarly, it was higher in *Echinochloa colona* in rice under rice – rice cropping system than that in brinjal under rice – wheat/mustard/vegetables cropping system. Higher seed rain depends on the higher survival per cent of the weed and increased production of fruits and seeds at the time of harvest of crop. As *Spergula arvensis* and *Solanum nigrum* possessed higher number of fruits/plant and seeds/fruit, their seed rain were higher. Similarly, higher survival per cent of *Echinochloa glabrescens, Setaria glauca, Dactyloctenium aegyptium, Chenopodium album, Mollugo stricta* resulted in higher seed rain. From the seed rain data of different weed species it can be easily assumed how much seeds are being deposited in a given area per season. This study may be conducted in other agro-climatic regions of West Bengal for generating data on the weeds in developing weed management technologies.

SUMMARY

The study was carried out to document the density, survival and seed production potential as seed rain, through a single value, of important weeds under different cropping systems at the districts Bankura, Birbhum and Burdwan representing lateritic belt of West Bengal during 2011-12 and 2012-13. Twenty four weed species under 22 genera and 14 families were studied in 9 crops. Highest density was recorded in *Mollugo stricta* in rice under rice – rice system, in *Oldenlandia corymbosa* in rice under rice – wheat/mustard/ vegetables system, whereas *Digitaria sanguinalis* recorded highest density in winter and pre-*Kharif* crops. Highest survival per cent was recorded in *Commelina nudiflora* and seed rain in *Spergula arvensis.*

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