Phenological studies of rice weeds in Bilaspur district, (Chhattisgarh)

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Abstract

Phenology is the study of periodic events in biological life cycles and study of changes in the timing of seasonal events such as germination, vegetative growth, flowering, fruiting, dormancy, migration, and death rate. phenological studies of weed flora is done in pot culture and in selected field area of Bilaspur district (C.G.). The phonological studies of rice weed flora have been done in the month of July to October 2023. Weeds are unwanted plant for any agriculture land. There are 30 weeds species are germinate in field area and 21 weeds species are germinate in pot culture. Those weeds grown in field condition came to 60% flowering earlier than pot culture weeds. *Echinochola crus-galli* has higher number of seeds in both pot culture and field area with 630-870 seeds respectively. Mostly weeds are germinated in July to September, their vegetative growth period is August to September, their reproduction period is October to November and they produce seed for germination is November to December.

Key words : Rice weeds, Germination, Culture, Phenology, Bilaspur district.

Rice (*Oryza sativa* L.) is a member of poaceae and it is important food crop by majority of world's population. It provides 20% of the total calories intake of people in the world⁶. Among the cereal crops, it serves as the principal source of nourishment for over half of the global population⁵. Among the cereals rice is the leading crop worldwide² and

more than half of the human race depend on rice for their daily substance⁴. Rice is the extensively cultivated all over the country. In Chhattisgarh rice is the staple food crop of all the population and rice is an important target to provide food security and livelihood for millions people. Rice is the first source of income and employment of many state formers. There

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are many variety of rice are grown in Chhattisgarh. Paddy is the identity of Chhattisgarh therefore it is called rice bowl of Chhattisgarh.

Weed succession and distribution pattern in rice field are dynamic in nature. The composition of weed flora may differ depending on location^{3,16}. Weed is a harmful and invasive species for rice, causing serious yield reduction in rice production worldwide. Weeds commonly absorb added nutrients as much and more rapidly than crops and also competing for nutrients, light, space and moisture throughout the growing season^{8,9,13}. The main reduction in rice yield caused by weeds competition is 40-60% which may rich 94 to 96% if weed are not properly controlled⁴. The (DSR) direct seeded rice fields are more species rich with greater diversity in weed flora then (TSR) transplanted seeded rice¹⁵.

An experimental study was conducted to study the phenology of rice weeds. However the growths of weeds were observed in field area and pot culture. Weed phenology relates to the plant attributes such as morphology, competitive ability, germination, vegetative growth, reproduction, seed dormancy, physiology of growth. Phenology is the study of changes in the timing of seasonal calendar such as flowering, fruiting, germination, dormancy and migration¹². Changes in phenology are linked with the growing season and effect ecosystem functioning and productivity. Knowledge of weed phenology is essential for the weed control and to protect the rice plant from damage caused by it. Phenology of weed plant is show by a benzene ring which is representing the life form of the weed plant. By studying weed phenology we also get knowledge about weeds, how harmful weed is for rice plant and environment. Benzene ring showing Phenology of plant –



When the phenology of a plant is represented by a hexagonal benzene ring, it is called the phenogram of that plant.

Study area : Bilaspur district is located in the northern region of Chhattisgarh state. The geographical distribution of the Bilaspur district is 25°.5'North latitude and 82°.12' East longitude¹⁴. Climatic conditions are generally sub tropical and humid type. The climate is good for agriculture growth and development. The highest rainfall of the year 2023 is 537.9mm. and 194.6 mm. in the month of August and September. Lowest rainfall is 2.6mm. and 1.6 in the month of April and November. The maximum temperature of the year 2023 is 41.2°C and 40.1°C in the month of April and May. Minimum temperature is 24°C and 18°C in the month of December and January. Highest humidity of the year 2023 is 94.5, 93.0, 93.1 and 93.7 in the month of January, July, August and September. Lowest humidity is 41.6, 41.3 and 42.8 in the month of March, April and November. (Source: -Climate department, Barrister Thakur Chhedilal college of Agriculture & Research Station Bilaspur Chhattisgarh.)

General study was done in the month

of July to November 2023 in Bilaspur district. The study was conducted to know the phenology of rice weed species in pot culture and in field area. Obtained weed plants were identified with the help of available literature and standard flora¹¹ and also rice weed were identified according to Harada *et al.*,⁷.



(Figure1) Geographical location of Chhattisgarh and Bilaspur

Weeds collection : weeds species seed was taken by survey of rice field to know the effect and phenology of weeds species. The seeds of weeds species were collected along with the inflorescence from the field and it was cleaned to remove the seeds. After that we dry the seeds at a certain temperature. The collected seeds were used for both pot experiment and field study.

Weeds culture : For the pot culture study, to fill the pots, we take soil from the field up to ³/₄th level. After filling the pot with soil, we put weed seeds in pot and irrigate it with water. We have taken 24 pots for pot culture. We obtained 21 weeds species from pot culture. In field study, 30 seeds were sown in the plot. Following phonological parameter were taken by the adopting standard method: day of emergence, germination percentage, day of growth, number of leaf, length of leaf, flowering time, fruiting time, death time, number of seeds and fruits per plant. All obtained weed plants in field area phenology were given in table-1.

S.	Species Name	Family	Phenogram Studies of Weed Plants			
No.		- w	Rainy	Winter	Spring	Summer
			Season	Season	Season	Season
1.	Echinochola crus-galli L.		$\widehat{\mathbf{A}}$	\overleftrightarrow	α	-
2.	Echinochloa colona L.	Poaceae	$\widehat{\mathbf{A}}$	\overleftrightarrow	(\mathbf{X})	-
3.	Cynodon dactylon L.		$\langle \rangle$	\rightarrow	\bigcirc	\bigcirc
4.	Paspalum scrobiculatum L.		$\widehat{\mathcal{V}}$	\downarrow	\bigcirc	-

Table-1. Phenological observation of rice weeds in field area

(1482)

5.	Paspalum distichum Auct.		\checkmark	K	-	\bigcirc
6.	Digitaria ciliaris Retz.		\sim	R	\bigcirc	\mathcal{Q}
7.	Eleusine indica L.		\rightarrow	А	\bigcirc	\bigcirc
8.	Cyperus rotundus L.	Cyperaceae	\sim	Я	\bigcirc	\mathcal{Q}
9.	Cyperus difformis L.		$\langle \rangle$	\Rightarrow	(\mathcal{X})	-
10.	Cyperus distans L. F.		$\langle \rangle$	\rightarrow	Σ	-
11.	Cyperus pilosus Vahl.		$\neg \bigcirc$	Y	\bigcirc	\bigcirc
12.	Cyperus esculentus L.		$\langle \rangle$	4	Δ	-
13.	Eclipta prostrata L.			\Diamond	X	-
14.	Parthenium hysterophorus L.	Asteraceae		\triangleleft	\bigcirc	\Diamond
15.	Tridex procumbens L.		\bigcirc	$\neg \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$	(-
16.	Bidens pilosa L.		\mathcal{P}	ł	\bigcirc	\Diamond
17.	Bidens bipinnata L.		\rightarrow	7	-	$\hat{\mathbf{Q}}$
18.	Sphaeranthus indicus L.		\bigcirc	\rightarrow	\propto	-
19.	Achyranthes aspera L.	Amaranthaceae		$\left\{ \right\}$	\bigcirc	-
20.	Alternanthera sessilis (L.)		\bigcirc	(\mathbf{x})	-	$\hat{\nabla}$

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21.	Amaranthus viridis L.		\downarrow	\Diamond	\bigcirc	\bigcirc
22.	Croton bonplandianum L.	Euphorbiaceae	$\langle \mathbf{P} \rangle$	$\neg $	\diamond	-
23.	Euphorbia hirta L.		$\langle \cdot \rangle$	\rightarrow	\diamond	d
24.	Euphorbia prostrata Aiton		\mathcal{R}	\rightarrow	Q	-
25.	Phyllanthus urinaria L.		\mathcal{R}	\rightarrow	Q	-
26.	Sida acuta Burm. f. ⁽¹⁾	Malvaceae	-	\mathcal{R}	\Diamond	Ŗ
27.	Sida cordifolia L.		$\langle \cdot \rangle$	\triangleleft	Я	-
28.	Cassia tora L.	Fabaceae		\bigcirc	-	-
29.	Desmodium triflorum L.		$\widehat{\mathbf{Q}}$	\checkmark	α	-
30.	Lippia nodiflora L.	Verbenaceae	-	\Diamond	\heartsuit	Å

The growth rate and phenogram of all weed plants of field area is shown below in the benzene ring with percentage-



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Some photographs of rice weeds in field area :



Echinochloa crus-galli L.



Cyperus rotundus Linn.



Echinochloa colona L.



Eclipta prostrata L.



Cyperus iria L.



Dactyloctenium aegyptium L.

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S.			Phenogram Studies of Weed Plants			Plants
No.	Species Name	Family	Rainy	Winter	Spring	Summer
			Season	Season	Season	Season
1.	Echinochola crus-galli L.		\mathcal{P}	\rightarrow	\propto	-
2.	<i>Echinochloa colona</i> L.	Poaceae	\rightarrow	\rightarrow	\propto	-
3.	Eleusine indica L.		\rightarrow	Y	$\widehat{\mathbf{Q}}$	\bigcirc
4.	Cynodon dactylon L.		\bigcirc	\rightarrow	\bigcirc	\leq
5.	Digitaria ciliaris Retz.		\checkmark	Å	$\widehat{\mathbf{Q}}$	\mathcal{O}
6.	Paspalum scrobiculatum L.		$\widehat{\mathbf{A}}$	\rightarrow	\bigcirc	-
8.	Cyperus rotundus L.	Cyperaceae	\sim	Я	\bigcirc	\Diamond
9.	Cyperus difformis L.		\mathcal{X}	Ą	\propto	-
10.	Cyperus distans L. F.		$\widehat{\mathbf{A}}$	\rightarrow	\propto	-
11.	Cyperus iria L.		\Rightarrow	\rightarrow	\bigcirc	Я
12.	Cyperus esculentus L.		$\widehat{\mathbf{A}}$	\rightarrow	Q	-
13.	Eclipta prostrata (L.)	Asteraceae		ρ	Y	-
14.	Parthenium hysterophorus L.		\Diamond	\Diamond	Q	\Diamond
15.	Tridex procumbens L.		$\widehat{\mathbf{Q}}$	\checkmark	\propto	-
16.	Bidens pilosa L.		\bigcirc	X	$\widehat{\mathbf{Q}}$	\Diamond

Table-2. Phenological observation of rice weeds in pot culture

(1	4	8	6)	
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17.	Achyranthes aspera L.	Amaranthaceae	$\widehat{\mathcal{V}}$	\mathcal{C}	0	-
18.	Alternanthera sessilis L.		\sim	Я	-	\Diamond
19.	Croton bonplandianum L.	Euphorbiaceae	$\langle \rangle$	$\prec \uparrow$	β	-
20.	Phyllanthus urinaria L.		$\widehat{\mathbf{A}}$	5	\bigcirc	-
21.	Euphorbia hirta L.		$\widehat{\mathbf{Q}}$	\Diamond	\bigcirc	0

*There is more space in the field area than the pot area, so more plants grow in the field as compared to the pot culture.



In Pot culture phenogram and plant growth rate with percentage of weed plants are shown in benzene ring

There are many weeds species are found in pot culture and field study area .Only those few weeds species phenology are describe here which take more space, having deep root penetration, more competitor, more seeds, branches, invasive and serious yield reduction and dominant in this area. Other weeds and their phenological behavior and phonogram are shown in the table.

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Some photographs of rice weeds in pot culture with Rice plant-



Eleusine indica L.



Euphorbia hirta L.



Alternanthera sessilis L.



Echinochloa colona L.



Eclipta prostrata L.

Phenology of some weeds species -

1. Barnyard grass (Echinochloa crus-galli):

It is member of poaceae family. In experimental study we Shaw the Seedling emergence of Echinochloa crus-galli was at 7 days after showing in both field study area and pot culture and germination percentage was higher in the field area comparison to the pot culture because in field they large space to grow. Flowering and fruiting was higher in field area then pot culture. A day of flowering was 48-50 days in field condition. Leaf length was higher in field condition (391.5 cm^2 , plant). It produces large number of seeds (respectively 700-860) per plant. How ever there was no significant difference in 1000 seed weight between pot culture and field area¹. Dry weight is high in field condition than pot culture. Its root is buried deep in the soil. Echinochloa crus-galli is considered to be as one of the most competitive harmful and problematic weed for many crops including rice with yield losses up to 80% (Smith Jr., 1981).

2. (Nutgrass) Cyperus rotundus :

This weed species is a member of cyperaceae family and is a species of sedge. It is a perennial plant. In experiment study we Shaw seedling emergence of *Cyperus rotundus* was emergence in 6 days in both pot and field condition. Germination percentage was higher in field condition than pot culture. That may reach a height of up to 140 cm. (55 in.) in field condition and 130 cm. in pot culture. The leaves sprout in the ranks of three forms the base of the plant. Length of leaf is 5 to 20cm. long in

both pot culture and field condition. The flower stems have a triangular cross- section. It has been called "the world's worst weed" ¹⁰. Days of flowering were stay 35 to 40 days in both pot culture and field condition. The fruit is a three –angled type. It has rhizomes and tuber system. The rhizome can penetrate and go deep through root crops. Dissemination by seeds is very weak. So it spreads very fast by rhizome. It dry weight is high in field condition then pot culture.

3. Alternenthera sessilis (Sissoo spinach) :

This weed species is a member of Amaranthaceae family plant and s a perennial herb with prostrate stems, often rooting at the nodes. In experiment we Shaw seedling emergence in 7 days after showing in field condition and pot culture. Germination percentage was higher in field condition than pot culture. Leaves obviate to broadly elliptic 1-15 cm. long in both pot culture and field condition. Flowers are sessile spikes, bract and bracteoles shiny white 0.7-1.5 mm long in field and pot culture. It has many large branches in both pot culture and field condition. The fruit is 2 to 3 mm. long in both conditions. Seeds are in lens shaped. It spread by seed or some time by vegetative propagation. It dry weight is higher in field condition than pot culture. It is considered as weed plant and can grow in all soil types. The speed of its spread is very fast in all condition.

In this phonological study weed count observation shown 30 weed species are obtained in field experiment belonging to 8 families and 21 genera (table-1). In pot culture study we obtain 21 weed species belonging to 5 families and 15 genera (table-2). Bottom of the table, (1 & 2) the phonological growth rates of all the weeds plant are shown with a benzene ring, called the phenogram of the plant. Echinochloa crus-galli germinated very fast and it have much seeds 700- 860 respectively per plant. Echinochloa colona L., Paspalum scrobiculatum L., Echinochloa crus-galli, Cyperus rotundus L. Cyperus difformis L. Eclipta prostrata L. Bidens pilosa L. and Alternanthera sessilis (L.) are dominant weeds in field area. According to table (1) 13 weed plants were germinate in month of June to July and 4 plants were germinate in August to September and 3 plants germinate throughout the year and 10 plants were germinate in month of February to May. 22 weed plants were flowering in month of June to November and 3 plants flowering throughout the year and 5 plants were flowering in December to May.18 weed plants were give fruit in month of August to November and 4plants were fruiting in November to April and 3 plants fruiting throughout the year and 5 plants November to December. According to table (2) less weed species were obtained in pot culture then field area. Similar results are found by many researches such as Begum et al.,³ in Peninsular Malaysia. Tomita et al.,¹⁵ in north east Thailand, Hassan Akhgari (2011) in northern part of Iran. Hayat⁸ (2004) in Pakistan. R. k. Naresh et al., (2013) in Western part of Uttar Pradesh. The studies of all these researches are discussion in weed problem and their effect in paddy field.

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