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LABORATORY AND FIELD SCREENING OF ALLELOPATHIC POTENTIAL BREAD WHEAT (*Triticum aestivum* L.) VARIETIES IN BANGLADESH

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Abstract

Minimizing the use of herbicides for eco-friendly weed management in wheat (*Triticum aestivum* L.) has become increasingly necessary. A series of experiments were conducted to screen the potential allelopathic wheat varieties of Bangladesh. In the laboratory these studies used radish (*Raphanus sativus* L.) and lettuce (*Lactuca sativa* L.) as model receiver plants, along with lambsquaters (*Chenopodium album* L.), and slender amaranth (*Amaranthus viridis* L.) as test weeds, for the initial allelopathic activity screenings of 13 wheat varieties of Bangladesh. In the laboratory studies, the wheat var. BARI gom21 produced the highest inhibition effect on C. album roots and also reduced the speed of germination of seeds of *R. sativus*, *L. sativa*, *C. album*, and *A. viridis*. BARI gom21 also significantly affected the coefficient of the velocity of germination of *A. viridis*. The focus of field studies was on 11 wheat varieties, which had previously been screened in the laboratory. These eleven wheat varieties were selected and cultivated in the field using standard cultural practices, but with no additional weed control. The field studies showed that wheat var. BARI gom21 had the lowest weed infestation with maximum weed control efficiency. In addition, the var. BARI gom21 were free of many weed species, including *C. album* and *A. viridis*. Therefore, BARI gom21 was the most weed suppressive variety among the tested varieties.

Keywords: Allelopathy, *Amaranthus viridis***,** Bread wheat, *Chenopodium album*, Weed suppression.

Introduction

Weeds are generally defined as, any undesirable plants that compete for water, nutrients, space, and light with crops, limiting crop growth and productivity. Depending on the environmental settings and type of cropping practices, weeds can cause about 45-95% yield losses (Masum *et al*., 2016). Among many factors, the yield losses due to weed infestations primarily depend on the types of weeds, density of infestations, weed emergence time relative to the crop, and interference duration. In 2020-21, the total production of wheat in Bangladesh is 12.34 million metric tons in an area of 3.40 million

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hectares (BBS, 2021). However, weeds are a major threat to wheat grain yield and cause about 18.6% losses (Gharde *et al*., 2018). Some of the major weeds of the wheat fields in Bangladesh are Bermuda grass (*Cynodon dactylon* L.), goose grass (*Eleusine indica*), large crabgrass [*Digitaria sanguinalis* (L.) Scop.], purple nutsedge (*Cyperus rotundus* L.), lambsquarters (*Chenopodium album* L.), wood sorrel (*Oxalis acetosella* L.), ground cherry (*Physalis heterophylla* Nees), hairy vetch [*Vicia hirsuta* (L.) Gray], diamond flower (*Hedyotis brachypoda*) and chickweed (*Stellaria media* L.) (Hossain *et al*., 2010). Their effective control is needed to achieve optimum and sustainable grain production in wheat.

Since mechanical weed control is costly; farmers in Bangladesh often use herbicides for weed control, often alone, or in combination with other methods. However, the excessive use of herbicides can lead to herbicide-resistant weeds and herbicide persistence in soil and water, which can lead to contamination (Ofosu *et al.,* 2023). Alternative weed management approaches, such as allelopathy, can be 'eco-friendly' novel tools for weed control. Allelopathy is generally defined as, the biochemical interaction among all plants, by which a plant may cause any direct or indirect, harmful, or beneficial effects to another plant through the release of allelochemicals. Allelochemicals are mainly secondary metabolites or waste products of primary metabolic pathways in the environment (Masum *et al.,* 2019). Allelopathic crops can be used to control associated weeds, and exploiting allelopathic crops is an important part of integrated weed management in recent years. Recent studies have already explored the allelopathy of several cereal crops such as rye, sorghum, canola, mustard, rice as well as durum wheat, and barley (Scavo and Mauromicale, 2021).

Wheat also has strong allelopathic potential against weeds. Allelochemicals from wheat straw, root exudates, notably, phenolic acids (p-hydroxybenzoic, ferulic, syringic, *vanillic, p-coumaric*), benzoxazinoids, as well as phenoxazinones, flavonoids and short-chain fatty acids, have potential to be exploited for weed control (Hussain *et al.,* 2022). Wheat genotypes to possess significant allelopathic potential against common weeds, such as canary grass (Phalaris minor), and wild oat (*Avena fatua* L.) (Mardani *et al.,* 2014). Recent studies show that wheat can suppress weeds in both laboratory and field conditions. Compounds in wheat root exudates, like phenolic acids and flavonoids, significantly inhibit key weeds such as *Bromus japonicus* and *Chenopodium album* (Younesabadi *et al.,* 2019; Hussain *et al.,* 2022). However, the exploration of the allelopathic potential of bread wheat varieties has not been adequately studied in Bangladesh. Thus, research to characterize the allelopathic potential among Bangladeshi wheat varieties appears an important forward step in developing allelopathy-based sustainable weed management systems in wheat. The primary objective of this study was to evaluate the allelopathic potential of major wheat varieties in Bangladesh against common weeds through both laboratory experiments and field trials.

Materials and Methods

The present research was conducted in the central laboratory and agronomic fields of the Sher-e-Bangla Agricultural University (SAU), Dhaka, Bangladesh (23°46′17″N latitude and 90°22′31″E longitudes) during the period September 2018 to March 2019. Thirteen Bangladeshi wheat varieties released by Bangladesh Agricultural Institute (BARI) were collected and used in the laboratory experiments. Common weeds - *Chenopodium album* and *Amaranthus viridis* were also collected from the fields of Sher-e-Bangla Agricultural University and used as receiver plants. Radish (*Raphanus sativus*) and lettuce (*Lactuca sativa*) were used as model plants for bioassay.

Donor receiver bioassay

In the laboratory screening, the donor-receiver bioassay technique was used to select some possible allelopathic varieties as described by Wu *et al*. (2000a) and Kato-Noguchi *et al*. (2002). Wheat seeds were moistened by filter papers in Petri dishes (9 cm) and germinated in a growth chamber for two days under a 12/12 h dark/light period. Uniformly germinating wheat seedlings were transferred to Petri dishes (ten wheat seedlings per Petri dish) that contained a filter paper moistened with 2.5 mL of 1 mM phosphate buffer (pH) and grown for an additional 48 h. Ten seeds of *R. sativus* and *L. sativa* were also placed into the filter paper, containing the growing wheat seedlings. In the case of *C. album* and *A. viridis*, the seeds were pre-germinated by soaking in distilled water for 36 h, transferred into a Petri dish containing a sheet of moistened filter paper, as described above, and then incubated in dark at 25°C for 48 h. Finally, the germinating seeds were placed into the filter paper with the growing wheat seedlings. Wheat, as well as the 'receiver' weed species, were then allowed to grow for 48 h before growth measurements. The shoot (hypocotyls and/or coleoptiles) and root lengths of *R. sativus*, *L. sativa*, *C. album*, and *A. viridis* were measured. Along with the experimental treatments, control plants were established by treating and incubating the receiver species by the same procedure as above, in absence of wheat seedlings. Each experimental unit contained ten donor (wheat) seedlings and ten receiver seedlings (*R. sativus*, *L. sativa*, *C. album*, and *A. viridis*)

The experimental design for bioassay was a completely randomized design (CRD) with four replications.

Percentage inhibition was determined by the following formula (Lin *et al*., 2004).

$$Inhibition\ (\%) = \frac{\text{Control plant length – Plant length infested with wheat}}{\text{Control plant length}} \times 100$$

The speed of germination was calculated by the following formula given by Gairola *et al.* (2011).

Speed of germination = $N_1/D_1+N_2/D_2+N_3/D_3+\ldots\ldots\ldots.N_n/D_d$

Where, N = number of germinated seeds, D= number of days.

The coefficient of the rate of germination of the receiver plant was measured by the following formula (Al-Mudaris, 1998).

$$(CRG) = \frac{(N1+N2+\ldots\ldots.+Nn)}{(N1T1)+(N2T2)+\ldots\ldots.(NnTt)} \times 100$$

Where, N_1= Number of germinated seeds on time T_1, N_2= Number of germinated seeds on time T_2, and Nn= Number of germinated seeds on time Tn

Field experiment

Eleven wheat varieties were selected based on both allelopathic and non-allelopathic from the laboratory test for the field study. The seed of wheat varieties was broadcasted in the respective plots. Irrigation and fertilizer were applied at recommended times and doses. Weeds of each plot were allowed to grow, collected after the critical period of weed competition, and sundried overnight, and then oven-dried for 48 hrs. at a temperature of 60°C to determine the dry weight. Randomized Complete Block Design was followed in the experiment with three replications.

Weed control efficiency was calculated by using the formula suggested by Mani *et al*. (1973).

$$WCE = \frac{\mathrm{DWC} - \mathrm{DWT}}{\mathrm{DWC}} \times 100$$

Where DWC = dry weight of weeds from control plots (weedy plots) and DWT = dry weight of weeds in treated plots.

Statistical analysis

The analysis of variance (ANOVA) and least significance difference (LSD) was performed with the Statistix 10 software package and the LSD test used a 5% level of significance.

Results and Discussion

Laboratory study (Donor-Receiver Bioassay)

In the donor receiver bioassay test significant differences in growth inhibition were observed on test plants due to different wheat varieties (Table 1). In the short-term co-cultivation of wheat varieties with test species and weeds, the highest level of inhibition caused by the BARI gom21 variety resulted in 81% root growth inhibition of *C. album*. On the other hand, the case of shoot of *C. album* BARI gom27 showed maximum inhibition (49%). BARI gom21 (52%) resulted in the highest inhibitory effect on *R. sativus* root but the shoot growth was restricted by BARI gom25 (67%). While BARI gom30 (48% inhibition in root) gave a stimulating effect on *R. sativus*. BARI gom30 (46%) and BARI gom21 (42%) showed over 40% growth inhibition on *A. viridis* root. The highest level of shoot inhibition in *A. viridis* was caused by BARI gom25 (53%). BARI gom26 (65%) and BARI gom 21 (57%) demonstrated the highest growth inhibition of *L. sativa* roots. Interestingly, some wheat varieties such as BARI gom29 (-4% inhibition) and BARI gom31 (-10% inhibition) stimulated the root growth of *L. sativa*. The highest (24%) shoot inhibition of *L. sativa* was observed from BARI gom28. Significant differences in growth inhibition were observed among wheat varieties in an equal compartment agar method bioassay test on little seed canary grass (*Phalaris minor*) (Kashif *et al*., 2015).

Table 1. The Allelopathic potential of wheat varieties on selected weed species in donor-receiver bioassay under laboratory conditions

Variety	Inhibition (%)							
	C. album		*R. sativus*		*A. viridis*		*L. sativa*	
	Root	Shoot	Root	Shoot	Root	Shoot	Root	Shoot
BARI gom21	81a	32.94c	52.13a	61.14b	42.48b	41.50c	56.65b	6.71d
BARI gom22	30.5f	33.88c	32.31b	52.65de	34.29d	32.42e	47.27c	3.45fg
BARI gom23	46.98d	36.18c	-29.55j	49.56ef	24.35f	40.10c	8.60h	12.22c
BARI gom24	37.44e	24.1d	9.14e	59.65bc	23.2f	26.97f	38.66e	2.21g
BARI gom25	64.20b	33.12c	26.10c	67.40a	14.22h	52.60a	44.13d	12.97c
BARI gom26	30.81f	43.62b	4.14f	56.18cd	-30.48j	23.36g	65.23a	4.82ef
BARI gom27	46.05d	49.24a	18.39d	46.78fg	18.43g	33.85de	3.91i	12.81c
BARI gom28	56.61c	22.83d	-1.92g	55.06d	31.48e	11.19h	17.84g	23.59a
BARI gom29	34.75ef	21.37d	-25.58i	47.54fg	39.03c	45.31b	-4.18j	7.27d
BARI gom30	49.32d	32.24c	-48.20k	52.56de	45.51a	45.88b	48.54c	14.77b
BARI gom31	49.32g	35.68c	32.54b	45.43g	12.76h	36.26d	-9.97k	6.24de
BARI gom32	45.87d	34.39c	32.46b	59.70bc	18.60g	2.05i	9.18h	6.29de
BARI gom33	46.14d	36.34c	-21.07h	36.41h	-8.03i	41.74c	35.45f	6.63fg
LSD $_{(0.05)}$	5.47	2.26	2.76	4.07	1.82	2.93	3.08	1.58
CV (%)	8.42	8.88	30.97	5.36	6.21	6.16	7.75	12.24

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at a 0.05 level of probability by LSD test

Speed of germination of the receiver plant

The calculated indices provided in Tables 2 & 3 showed different wheat varieties significantly affected the germination speed of the receiver plants. BARI Gom 21 reduced the speed of germination (5.35, 4, 4.32, and 5.83) against *R. sativus*, *L. sativa*, *C. album* and *A. viridis*. BARI gom21 also reduced the coefficient of velocity of germination of *A. viridis* (1.92). Masum *et al.* (2016) observed significant differences in germination parameters among rice varieties, noting that certain allelochemicals delayed the germination of *Echinochloa crus-galli* and significantly affected the germination index, speed, and coefficient of germination rate. However, in all receiver species, inhibitions on root growth were greater than those on shoot growth. Previous studies also reported greater inhibition of root growth than shoot growth by an allelopathic crop (Olofsdotter and Navarez, 1996). Allelopathic inhibition of annual ryegrass ranging from 3 to 100% was also reported (Wu *et al*., 2003a; Wu *et al.,* 2003b).

Table 2. The effect of allelopathic wheat varieties on the speed of germination of different receiver species in donor-receiver bioassay under laboratory conditions

Variety	Speed of germination			
	C. album	*R. sativus*	*A. viridis*	*L. sativa*
BARI gom21	5.35i	4.00j	4.32g	4.83i
BARI gom22	6.00f	4.83h	5.83a	5.66e
BARI gom23	5.50hi	5.50f	5.67b	6.66a
BARI gom24	6.83e	6.00c	5.67b	6.50b
BARI gom25	5.67gh	7.00a	5.83a	5.66e
BARI gom26	5.83fg	5.83d	5.17d	5.33g
BARI gom27	5.75g	5.67e	5.83a	5.99d
BARI gom28	6.83e	4.67i	4.83e	5.49f
BARI gom29	6.00f	5.16g	5.83a	6.50b
BARI gom30	7.83c	5.83d	5.33c	5.66e
BARI gom31	8.49a	6.17b	4.66f	6.33
BARI gom32	8.18b	5.67e	5.67b	5.50f
BARI gom33	7.66d	5.67e	5.83a	5.17h
LSD $_{(0.05)}$	0.17	0.09	0.05	0.07
CV (%)	1.83	1.17	0.71	0.91

In a column means having a similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at a 0.05 level of probability by LSD test

Table 3. The coefficient velocity of germination of different receiver species in donor-receiver bioassay under laboratory condition

Variety	The coefficient velocity of germination			
	C. album	*R. sativus*	*A. viridis*	*L. sativa*
BARI gom21	2.22e	2.03e	1.92e	1.97f
BARI gom22	2.19f	2.03e	2.03d	2.15b
BARI gom23	2.02i	1.96f	2.16b	‘2.19a
BARI gom24	2.25d	2.39a	2.08c	2.14c
BARI gom25	1.98j	2.34b	2.08c	1.97f
BARI gom26	2.02i	2.15c	1.93e	1.97f
BARI gom27	2.08h	1.96f	2.03d	2.08d
BARI gom28	2.25d	1.92g	1.93e	2.03e
BARI gom29	2.14g	2.08d	2.08c	2.14c
BARI gom30	2.37b	2.03e	2.03d	2.13c

Variety	The coefficient velocity of germination			
	C. album	*R. sativus*	*A. viridis*	*L. sativa*
BARI gom31	2.52a	2.03e	2.08c	2.08d
BARI gom32	2.37b	2.08d	2.08c	2.03e
BARI gom33	2.31c	1.96f	2.21a	1.93g
LSD $_{(0.05)}$	0.013	0.029	0.015	0.013
CV (%)	0.41	1.00	0.52	0.46

In a column means having a similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at a 0.05 level of probability by LSD test

From Fig. 2, it is also observed that across all the wheat varieties, *C. album* (39%) was the most inhibited when grown with wheat seedlings, followed by *R. sativus* (30%), *A. viridis* (27%), and *L. sativa* (18%). Based on donor-receiver bioassay results, the maximum average inhibition on test plants and weeds was from BARI Gom 21 (47%) followed by BARI gom25 (39%) and BARI gom22 (33%) (Fig. 3).

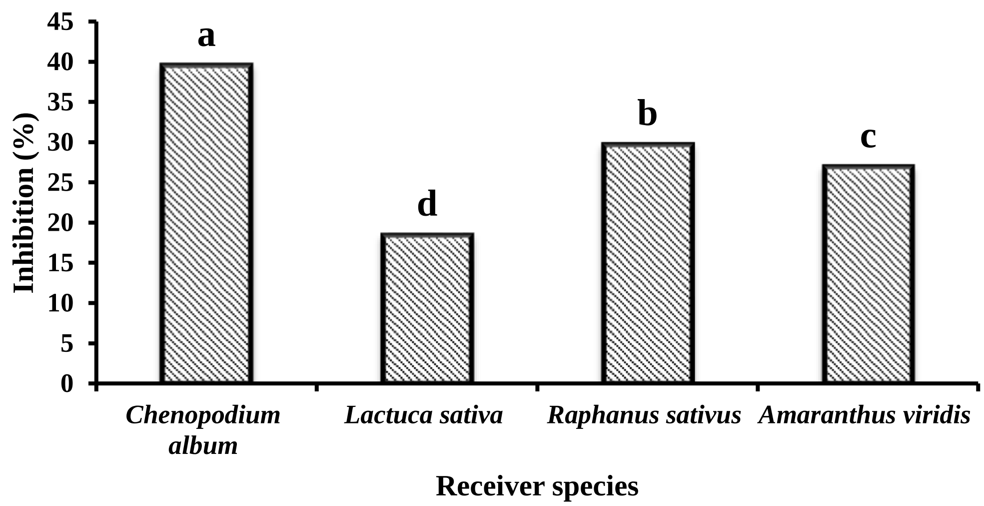

Fig. 2. Average inhibition on receiver species due to infestation with irrespective of wheat varieties.

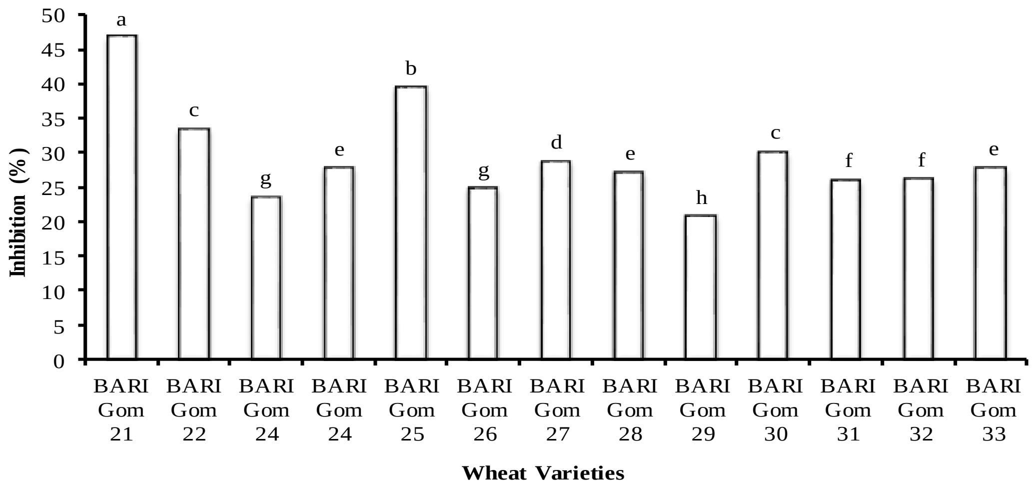

Fig. 3. Average inhibition irrespective of receiver species by tested wheat varieties from donor-receiver bioassay test

Field experiment

Weed density in no weeding plots at 15, 25, and 35 days after broadcasting were more or less similar for different wheat varieties (Table 4). BARI gom21 reduced the weed density (14.66 m^{-2}, 28.33 $m^{-2,}$ and 33.33 m^{-2}) at 15, 25, and 35 DAS. BARI gom21 thus reduced weed biomass (12.02g m^{-2}) showing the maximum weed control efficiency (86%) in the field test followed by BARI gom23 (84), BARI gom29 (81), BARI gom28 (41) (Table 5). In the field experiment, BARI gom21 raised plot was less infested by weed and showed the lowest (12.02 g m^{-2}) weed dry matter (Table 5) followed by BARI gom23, BARI gom29, and BARI gom28 raised plots showed 14.65, 16.33 and 17.17 g m^{-2}, respectively as statistically similar. On the contrary, the highest weed dry matter was recorded in BARI gom22 (29.44 gm^{-2}) followed by BARI gom24 (28.20 g m^{-2}). A similar result was recorded by Hossain *et al.* (2010).

Table 4. Weed density in different wheat varieties raised plots on different days after sowing (DAS)

Wheat variety	Weed density (no. m^{-2})		
	15 DAS	25 DAS	35 DAS
BARI gom21	14.66f	28.33d	35.33d
BARI gom22	17.33ef	33.00b-d	59.33b
BARI gom23	22.33c-f	29.33d	35.33d
BARI gom24	20.66d-f	32.66b-d	54.00bc
BARI gom25	19.66d-f	35.00b-d	44.66cd
BARI gom26	27.33b-d	39.00b	53.33bc
BARI gom27	23..33c-d	3066d	44.33cd

Wheat variety	Weed density (no. m^{-2})		
	15 DAS	25 DAS	35 DAS
BARI gom28	32.33b	28.66d	46.33cd
BARI gom29	28.66bc	31.00cd	37.66d
BARI gom30	22.33c-f	30.33d	54.33bc
BARI gom31	21.66c-f	38.00bc	51.66bc
Weedy plot	41.66a	62.66a	91.33a
LSD $_{(0.05)}$	7.93	7.05	11.28
CV (%)	19.26	11.94	13.16

In a column means having a similar letter (s) are statistically similar and those having dissimilar letter(s) differ significantly at a 0.05 level of probability by LSD test

Relative weed density (%)

The weed species found in the experimental field were *Chenopodium album, Cynodon dactylon, Eleusine indica, Echinochloa colona, Solanum carolinense, Raphanus raphanistruma, Lindernia procumbens, Vicia sativa, Amaranthus viridis, Argemone mexicana, Corchorus acutangulus, Portulaca olerace, Nicotiana plumbaginifolia, Physalis heterophylla, Alternanthera philoxeroides, Heliotropium indicum,* and *Cyperus rotundus.* Of these, many species were under the family Poaceae, some species under Solanaceae and Amaranthaceae. Other species are Compositae, Cyperaceae, Chenopodiaceae, Brassicaceae, Boraginaceae, Portulacaceae. When classified based on habit, 30% of weeds were under grass, 65% under shrubs, and 5% under sedge. Similar findings were also reported by Hossain *et al.* (2010). The relative density of some major weed species was found in wheat plots during the experiment is shown in (Table 5). Interestingly some major weed species of wheat including *C. album and A. viridis* were not found in BARI gom21 and BARI gom30 raised plots.

Table 5. Relative weed density of different weeds in different plots of wheat and the weedy plot

Wheat Variety	Relative Weed Density (%)						
	C. album	*C. dactylon*	*E. indica*	*S. carolinense*	*L. procumbens*	*A. viridis*	*E. colona*
BARI gom21	0.00e	12.24a	31.11f	2.85bc	2.85bc	9.44b-d	3.78bc
BARI gom22	7.17b-d	12.29a	52.27a	2.01c	0.49c	5.59e	2.60c
BARI gom23	9.46ab	11.51ab	32.48ef	4.25a-c	7.88a	8.66c-e	5.72ab
BARI gom24	5.55d	12.38a	50.98ab	3.89a-c	4.63a-c	8.07c-e	3.04c
BARI gom25	10.61a	12.23a	38.32c-f	4.52a-c	6.08ab	13.47a	3.75bc
BARI gom26	5.95cd	10.05ab	50.26ab	3.58a-c	4.8sa-c	8.80b-e	2.83c
BARI gom27	7.57a-d	9.76ab	34.41d-f	4.46a-c	4.46a-c	11.95ab	2.98c
BARI gom28	0.00e	10.40ab	32.51ef	2.83bc	3.84a-c	13.11a	6.63a
BARI gom29	5.39d	12.37a	41.63b-e	6.16a	5.24ab	9.70bc	2.67c

Wheat Variety	Relative Weed Density (%)						
	C. album	*C. dactylon*	*E. indica*	*S. carolinense*	*L. procumbens*	*A. viridis*	*E. colona*
BARI gom30	9.18a-c	8.53ab	42.29b-d	4.91ab	3.77a-c	6.11e	3.61c
BARI gom31	8.99a-c	7.13b	39.65c-f	3.24bc	4.63abc	6.42de	3.19c
Weedy plot	5.32d	12.59a	45.96a-c	3.66abc	5.90ab	6.08e	5.84a
LSD $_{(0.05)}$	3.36	4.78	9.50	2.59	4.53	3.24	2.05
CV (%)	31.69	25.72	13.69	39.59	58.76	21.40	31.13

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability by LSD

Weed control efficiency (%)

In the field experiment, the raised plot of BARI gom21 was less infested by weeds and showed the lowest weed dry matter at 12.02 gm^{-2} (Table 6). This was followed by the raised plots of BARI gom23, BARI gom29, and BARI gom28, which showed 14.65, 16.33, and 17.17 gm^{-2}, respectively, and were statistically similar. In contrast, the highest weed dry matter was recorded in BARI gom22 at 29.44 gm^{-2} and BARI gom24 at 28.20 gm^{-2}. BARI gom 21 showed the maximum weed control efficiency (86%) followed by BARI gom23 (84%), BARI gom28 (81%), and BARI gom29 (81%) during the field experiment (Table 6).

Table 6. Above-ground dry matter weight of weed and weed control efficiency

Wheat Variety	Weed dry matter weight (g m^{-2})	Weed control efficiency (%)
BARI gom21	12.02g	86.47a
BARI gom22	29.44b	66.80e
BARI gom23	14.65fg	83.67ab
BARI gom24	28.20bc	68.08e
BARI gom25	22.32d	74.55d
BARI gom26	17.17d-g	80.59a-c
BARI gom27	16.43e-g	81.32a-c
BARI gom28	18.23 d-f	79.30b-d
BARI gom29	22.77cd	74.52d
BARI gom30	19.87d-f	77.58cd
BARI gom31	20.93de	76.89cd
Weedy plot	88.84a	
LSD $_{0.05}$	5.63	5.92
CV (%)	12.85	4.50

In a column means having a similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at a 0.05 level of probability by LSD test

The present work identifiesthe Bangladesh wheat variety BARI gom21 as allelopathic. The in vitro bioassay results were also successfully verified by comparing with field performance in terms of weed control, and successfully distinguished allelopathic effects from competition in crop-weed interference. This elite allelopathic wheat genotype could be used in breeding efforts to improve weed suppression traits in commercial varieties.

Conclusion

The present research suggested that 'BARI gom21' showed the most allelopathic performance to suppress weeds in both *in vitro* and field conditions out of 11 Bangladeshi bread wheat varieties. Therefore, this research beneficial for the resource-poor farmers of Bangladesh as well as for the researchers who work on the development of environmentally friendly sustainable weed management options. This information is important for organic farmers who have to control weeds without the use of herbicides. However, additional research is necessary to isolate and identify allelochemical(s) from the Bangladesh wheat variety 'BARI gom21' as bioherbicide by which significance in nature of allelochemicals could be found for attributing the constant need for new chemistries and new target sites. Moreover, this wheat variety could be developed by breeding and by adopting other agronomic practices for obtaining optimum yield performance and tolerance to weeds.

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Conflicts of Interest

The authors affirm that there are no conflicts of interest related to the publication of this manuscript.

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