Allelopathic Effect of Rice Aqueous Extract on Different Weed Species and Identification of the Potential Allelopathic Compounds

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ABSTRACT

The herbicidal effects of aqueous leaves, stem, root, hulls and straw extracts of eight rice cultivars from different part at different growing stage were evaluated against germination and growth of seven weeds and rice. Experiments were conducted to screen nine phenolic derivatives compounds in 3 rice cultivars (Sakha101 straw, Sakha103 straw and Yasmin hull) using HPLC. The results showed that, the hull aqueous extract from Yasmin gave the highest reduction of *Brassica niger* germination and fresh weight, it gave 66.65% and 23.72% decrease respectively. Sakha 103 leaf aqueous extract at six-leaf stage and at flowering stage gave the highest reduction in plant germination to tested weeds followed by Sakha 104 and Giza 177. Also within plants, *Lactuca sativa* was the most affected plant by the aqueous extract at six-leaf stage followed by *Echinochloa colonum*. In addition, *Echinochloa colonum* was the most affected one by the aqueous extract at flowering stage. Sakha 101, Sakha 102 and Sakha 103 were the most affected straw aqueous extract to all plant and weeds, followed by Giza 177 and Sakha 104 without significant deference between them. The HPLC analysis reveled that, ferulic acid was abundant component in Sakha101straw, Sakha103straw and Yasmin hull and the corresponding concentration were 4.826, 5.401 and 2.097 mg/g, respectively. This study may be a key step for determination many allelochemicals in rice cultivars and showed the effect of aqueous extracts for different parts of rice against some weeds.

Key Words : allelo chemicals, rice allelopathy, phenolic derivatives, HPLC.

INTRODUCTION

Allelopathy is defined as the directly or indirectly harmful or beneficial effects of one plant on another through the production of chemical compounds that escape into the environment (Fang *et al.* (2009); Chen *et al*, 2008; Fageria *et al.* (2008); (Kong, 2008) and Chung *et al.* (2001a). The term Allelopathy was coined by Molisch in (1973) and as a new method of weed control could lead to reduce labor costs and increased efficiency Chung *et al.* (2003).

The substances with allelopathic potential are present in virtually in all plant tissues, including stem, leaves, roots and seeds, there substances released through different processes such as volatilization, root extraction, leaching and decomposition of plant residues Reigosa *et al.* (1999), Chung *et al.* (2001b) and Chung *et al.* (2003), this phenomenon could be an alternative weed control method. For example, aqueous extracts of rice plant inhibited the growth of root and shoot of lettuce (*Lactuca sativa*), alfalfa (*Medicago sativa*), *Digetaria* sp. and duck salad *Heleranthera limosa* (Salam *et al.* (2009), and Ebana *et al.*(2001). Also, hull extract of 5 cultivars were highly inhibited the barnyard grass seedling growth Asghori *et al.* (2006). On, the other hand aqueous methanol extracts of Bangladesh rice (*Oryza sativa* L. cv. BR17) inhibited the growth of roots and shoots of cress (*Lepidium sativum*), lettuce (*Lactuca sativa*), alfalfa (*Medicago sativa*), timothy (*Phleum pratense), Digitaria sanguinalis, Echinochloa crus-galli* and *Echinochloa colonum* Salam *et al.*(2009). Many positive studies of Allelopathy as a mean of ecological weed control by selecting rice cultivars with higher allelopathic potential have been concluded (Ahn and Chung, 2000); Anjen *et.al.* (2005); Ko *et al.* (2005), Uremis *et al* (2005) and Javaid *et al.*(2006).

Weed management is a key element of the most agriculture system, but there has been increasing herbicide resistance in weeds and wide spread concern about adverse environmental effects from herbicide use, Chung *et al.* (2003). For this reason, the use of allelopathic rice varieties may provide an alternative way to minimize the risk to agroecosystems by serving in a complementary fashion with herbicides.

Rice (*Oryza Sativa*), is one of the principal food crop in Egypt, it is an annual summer crop, its production is characterized by the heavy use of fertilizers, herbicides, and pesticides, which may lead to environmental problems in both water and soil of the paddy field, some rice cultivars have demonstrated for allelopathic potential against most of the troublesome weed species in paddy fields Asghori *et al.* (2006).

Allelopathy can be used in weed management in two ways. First, by selecting an appropriate rice variety or incorporating an allelopathic character into a desired crop variety. Second, by applying

residues of straw or hull as mulches in a rotational sequence that allows residues to remain in the field Chung *et al.* (2003).

The objective of this study was to assess the phytotoxicity of allelochemicals to seed germination of many crops and weeds which were extracted from different part of many rice species grown in Egypt field and identification of allelochemicals from rice hull and straw from some rice varieties using HPLC.

MATERIALS AND METHODS

Eight rice cultivars, including Sakha 101; Sakha 102; Sakha 103; Sakha 104; Giza 177 and Giza 178; Giza 182 and yasmin were grown at Khafr El-Shiekh on Sakha research station farm in 2008 summer season,then harvested at different time intervals. The plant samples were leaves, stem, root, hulls and straw.

I. Aqueous extraction from rice parts:

According to Chung *et al.* (2000) root, stem (3cm from the basal node) and leaves were sampled from plants which grown in field at six–leaf stages and at flowering stage. Also, the harvested parts (leaves and strew), the sample were cut to small pieces and stored at 5^0C, after the seeds were hulled with milling machine, the hull were ground in mill through a 40 mesh screen. Aqueous extracts (w/v) were prepared by soaking 25 g plant materials with 100 ml. sterilized distilled water over night on a shaker. The filtrates were then centrifuge and the supernatant were used to the bioassay test.

II. Bioassay test :

All aqueous extracts were tested via germination of the following weeds and crops, (*Brassica niger*) black mustard, (*Hardeum vulgare* L) barley, (*phalaris minor*) canary grass, (*Lactuca sativa* L.) lettuce, (*Echinochloa crass-galli*) barnyard grass,(*Echinochloa colonum*) jungle rice, (*portulaca oleracea*) common perslane and (*Oryza Sativa)* rice, Giza 101. The seeds were placed on sterilized 9cm. Petri dishes and 10 ml. of each extract solution were added to each. After, 7 days, %germination and the fresh weight of all survival plants were determined. All data were statistically analyzed using $L.S.D_{0.05}$ to compare the means, according to Cohort software Inc, (1986).

III. Identification of allelochemicals from rice hull and straw using HPLC:

According to Chung *et al.* (2002), ground hull of yasmin rice variety (5gm) and ground straw of Sakha 101 and 103 (5gm) were extracted in 80% methanol and stirred for 24houre at room temperature, the filtrate were evaporated to dryness by using rotary evaporator at 40°C, the residue were re-dissolved in 10 volumes of 80% HPLC grade methanol. An aliquot of the samples were analyzed by HPLC.

Identified compounds, namely benzoic, ferulic, mcoumaric, o-coumaric, p-coumaric, o- analysis of hydroxyphenylacetic, p-hydroxybenzoic, salicylic, and syringic acids (Aldrich Chemical Co., USA), were used for HPLC analysis on the basis of the results of screening the phytotoxicity for allelochemicals. The technique to analyze the identified compounds was based on the method of Chung *et al.* (2000, and 2001a). The eight compounds were identified by their retention times with authentic standards, and concentrations were calculated by comparing peak areas of samples with those of the standards.

The samples were analyzed by HPLC system Perkin Elmer HP 200L, column C18 reversed. The solvents (A) comprised 98% water, and 2% glacial acetic acid in 0.018M ammonium acetate, and solvent (B) 68% water, 25% methanol, 5% butanol, and 2% glacial acetic acid in 0.018M ammonium acetate. Both extracts and standard compounds were used in the following gradient system according to Banwart *et al.* (1985). The wavelength of the UV detector was 280 nm. The reference compounds were chromatographed alone and in mixtures. Retention times of the standard compounds and the major peaks in the extract were recorded.

RESULTS AND DISCUSSIONS

A-Bioassay test:

The seeds germination percentage and fresh weight of the weeds and crops treated with aqueous extract of different rice species (different plant parts and growth stages) are present in Table (1-8).

I. The effect of hull aqueous extract:

In general, there were no significant difference between all hull aqueous extracts on all plants in comparing with distilled water on the percentage of seeds germination or on fresh weight Table (1 and 2). For example, Yasmin gave the highest reduction of *Brassica niger* germination and fresh weight, it gave 66.65% and 23.72% decrease respectively. Giza 177 gave also the highest reduction of *Hardeum vulgare* L by 61.65%. Sakha 104 gave 50% decrease of the *phalaris minor* germination and 29.27% decrease of its fresh weight. Sakha 103 was more effective on *Lactuca sativa* L.; it gave 73.91% and 64.29% decrease on germination and fresh weight respectively. Sakha 102, Sakha 103 and Sakha 104, completely inhibit the germination of *Echinochloa colonum*. On the other hand, there was no significant deference between hull extracts from all rice species on the germination percentages of Echinochloa *crass-galli*. These conformed by many workers, who mention that, may be genetic differences among many rice cultivars for allelopathic potential on barnyard grass using hull extracts from 91 cultivars (Ahn and Chung 2000). In general, *Echinochloa colonum* was the most affected weed through all rice extracts followed by *Lactuca sativa* plant on the decrease of its germination and fresh weight. Chung *et al.* (2002) reported that, little information is available on the hull extracts of rice cultivars with high allelopathic potential, although such allelopathic compounds in

Table 1: Allelopathic effect of hull aqueous extract from different rice species on seeds germination of some weeds and crops

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	20	20	20	15.33	19.33	15.33	26.33	20	19.54b
Sakha 101	16.33	12.33	12.33	7.67	19.33	4.67	20	19	13.96a
Sakha 102	18	12.33	12.67	6	19.33	0	20	20	13.54a
Sakha 103	17.67	10.67	12.67	4	18	0	19	18	12.50a
Sakha 104	17.5	10.33	10	5.33	19.33	0	20	18.67	12.65a
Giza 177	16.8	7.67	12.33	4.67	19.33	2.67	18.67	18.67	12.60a
Giza 178	17	10.33	14.67	13	18.33	9.33	19.33	18.67	15.08a
Giza 182	17	11	14.33	12.67	18.67	7.33	19.67	19.33	15.00a
Yasmin	6.67	11.67	11.67	11	12.33	13.67	14.67	18	12.46a
Total mean	16.33c	11.81c	13.41c	8.85b	18.22d	5.89a	19.74d	18.93d	

Table 2: Allelopathic effect of hull aqueous extract from different rice species on some weeds and crops fresh weight (g)

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	0.177	0.170	0.041	0.028	0.023	0.020	0.048	0.111	0.077b
Sakha 101	0.154	0.115	0.020	0.010	0.041	0.015	0.036	0.107	0.062a
Sakha 102	0.167	0.116	0,020	0.010	0.023	0.000	0.040	0.107	0.060a
Sakha 103	0.139	0.143	0.020	0.010	0.028	0.000	0.035	0.102	0.060a
Sakha 104	0.166	0.117	0.029	0.010	0.036	0.005	0.035	0.097	0.062a
Giza 177	0.132	0.158	0.028	0.015	0.020	0.011	0.034	0.093	0.061a
Giza 178	0.168	0.150	0.033	0.017	0.033	0.010	0.035	0.095	0.068a
Giza 182	0.167	0.160	0.040	0.021	0.023	0.015	0.034	0.086	0.068a
Yasmin	0.135	0.163	0.041	0.017	0.031	0.012	0.029	0.110	0.067a
Total mean	0.156f	0.144e	0.030b	0.015a	0.029b	0.010a	0.036c	0.101d	

rice may serve as natural herbicide by inhibiting seed germination of some weed.

II. The effect of aqueous extracts of different rice plant at 6-leaf stage:

The aqueous extracts of rice at 6-leafe stage, especially Sakha 103 was highly reduced germination of tested plants and weeds followed by Sakha 104 and Giza 177 leaves aqueous extracts and Giza 177 steam aqueous extracts without significant deference between them, On contrast the root aqueous extracts form all rice species were the least in this respect Tables (3 and 4). For example, Sakha 103 leaves aqueous extracts gave the highest reduction to *Brassica niger* germination, with 43.35%reduction and completely prevent the germination of *phalaris minor, Lactuca sativa* and *portulaca oleracea.* Also, Sakha 102 and Sakha 101 gave the highest reduction to *Hardeum vulgare* L germination; with 56.65% and 53.35% reduction respectively. In addition, all, leaf extract except Sakha 101 and Giza 178 and the stem extracts from Sakha 102 and Giza 178 completely inhibit the germination of phalaris *minor* and *Lactuca sativ* Meanwhile, *portulaca oleracea* was completely *a* inhibited by all extracts at this stage.

In general, within plants (*Lactuca sativa* L) was the most affected plant followed by *Echinochloa colonum* in the decrease of the germination and fresh weight, Ebana *et al.* (2001) reported that, water soluble compounds which were extracted from rice seedlings leaves at 6-leaf stage and adult plant, were inhibited the root growth of lettuce. On the other hand, there was no significant deference between all extracts on its effect on fresh weight compared with distilled water.

III.The effect of aqueous extracts of different rice parts at flowering stage:

The data recorded in Tables (5 and 6), revealed that, aqueous extract from Sakha 103 leaves at flowering stage gave the highest reduction on the percentage of germination within all plants followed by Giza 177 and Sakha 104 leaves aqueous extract. Sakha 102 leaves, inhibited the germination of *Hardeum vulgare* by 60% followed by Sakha 103 which gave 58.35% decrease of the germination of the same weed, Sakha 104 gave 39.13% decrease of the germination of (*Lactuca sativa* L). On the other hand, all parts of plant at this stage had no significant effect on the germination of *Brassica niger, Oryza sativa, Echinochloa crass-galli,and portulaca oleracea* In general, *Echinochloa colonum* was the most affected plant with aqueous extract of Sakha 103 and Sakha 104 leaves by 69.53% rduction of its germination, and aqueous

Table 3 : Allelopathic effect of 6-leafe stage aqueous extract from different rice species on germination of some weeds and crops

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	20.00	20.00	20.00	15.33	19.33	15.33	26.33	20.00	19.54e
Sakha 101 root	19.67	17.00	18.33	6.67	19.00	5.67	19.00	20.00	15.67cd
Sakha 102 root	17.00	17.00	18.67	7.00	19.33	5.67	19.67	19.33	15.46cd
Sakha 103 root	18.67	17.00	20.00	6.67	19.33	6.67	20.00	16.33	15.58cd
Sakha 104 root	18.33	16.67	17.00	7.33	19.33	6.67	19.33	17.33	15.25cd
Giza 177 root	11.33	17.67	17.00	8.00	19.33	8.00	19.33	16.67	14.67c
Giza 178 root	17.00	16.67	16.00	10.00	19.33	10.00	19.33	20.00	16.04d
Sakha 101 leaves	19.33	9.33	0.00	8.67	14.67	7.33	0.00	20.00	9.92bc
Sakha 102 leaves	11.33	8.67	20.00	0.00	15.33	8.00	0.00	18.33	10.21bc
Sakha 103 leaves	11.33	11.67	0.00	0.00	13.33	6.67	0.00	17.00	7.50a
Sakha 104 leaves	16.33	17.33	0.00	0.00	15.33	4.33	0.00	19.33	9.08b
Giza 177 leaves	15.67	11.33	0.00	0.00	17.33	10.67	0.00	20.00	9.38bc
Giza 178 leaves	19.00	9.33	13.00	12.67	17.33	7.33	0.00	20.00	12.33bc
Sakha 101 steam	19.33	15.33	0.00	4.33	17.33	10.00	10.00	19.33	11.96bc
Sakha 102 steam	17.33	11.33	19.33	6.67	17.33	12.67	20.00	12.67	14.67c
Sakha 103 steam	16.00	11.33	0.00	10.67	17.33	11.33	0.00	20.00	10.83bc
Sakha 104 steam	20.00	8.67	0.00	0.00	17.33	9.33	20.00	20.00	11.92bc
Giza 177 steam	19.67	8.00	0.00	4.67	17.33	9.33	0.00	20.00	9.88bc
Giza 178 steam	19.00	14.67	17.67	0.00	17.33	10.67	0.00	20.00	12.42bc
Total mean	17.17e	13.63d	10.37c	5.72a	17.49e	8.72b	10.16c	18.75f	

extract of stem of Sakha 101 Sakha 102 Sakha 103 and Giza 177 caused 73.90% reduction of this weed germination.

In addition to that, within extracts, all aqueous extracts had no significant deferent on plant fresh weight compared with distilled water.

IV. The effect of straw aqueous extract:

Table (7and 8) showed that, in general, Sakha 101, Sakha 102 and Sakha 103 was the most effective aqueous extractson all plant and weeds, followed by Giza177 and Sakha 104, without significant deference between them, There was no significant defference between Sakha 101, Sakha 102 and Sakha 103 on the decrease of germination, but they caused malformation and stunting to *Brassica niger* germinated seedlings. Sakha 101 and Sakha 103 gave the highest decrease of fresh weight to all plants followed by Sakha 102 without significant deference.

All aqueous extracts from straw had no significant effect on *Brassica niger, Hardeum vulgare* L, *phalaris minor* and *Oryza sativa* percentage of germination. Also, all aqueous extracts from straw caused significant decrease of the germination of *Lactuca sativa* L, *Echinochloa crass-galli, Echinochloa colonum* and *portulaca oleracea.*, for example, Sakha 101 caused 45.66% decrease on (*Lactuca sativa* L.) percentage of germination.

Also, within all extracts, Sakha 101 and Sakha 102 were the most effective extracts to all plant fresh weight followed by Sakha. 103. *Lactuca sativa, Echinochloa crass-galli, Echinochloa colonum* and *portulaca oleracea* were the most

plant affected by straw extracts, they gave the lowest fresh weight.

V.Determination of nine phenolic compounds detected by HPLC:

The most effective extracts of rice varieties against the tested plants were Sakha101straw, Sakha103 straw and Yassmin hull were identified by HPLC. HPLC analysis clearly demonstrated the presence of allelopathic materials in rice (straw and hull). In Table (9) showed the retention times and concentration of nine phenolic derivatives compounds (salicylic, p-coumaric, o-hydroxyphenyl acetic, syringic acids, ferulic, Benzoic, p-hydroxybenzoic, m-coumaric and o-coumaric) from some rice varieties. Based on the obtained data in Table (9), it can be concluded that, the o-hydroxyphenyl acetic, syringic, ferulic and m-coumaric acid were detected in all samples.

The results reflected that, ferulic acid exhibited the highly concentrations in Sakha 101straw, Sakha 103straw and Yassmin hull and the corresponding concentration were 4.826, 5.401 and 2.097 mg/g, respectively. These results are in agreement with the results of Rice (1987), who reported allelopathic activity of phenolics in the grass plant kingdom and of Chung *et al.* (2001b), who isolated phenolic acids, including o-hydroxyphenylacetic acid, from rice straw extracts. Chung *et al.* (2001a), who measured the level of nine phenolics including ferulic acid in cultivated and introduced

Table 4: Allelopathic effect of 6-leafe stage aqueous extract from different rice species on some weeds and crops fresh weight (g)

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	0.177	0.170	0.041	0.028	0.023	0.020	0.048	0.111	0.077b
Sakha 101 root	0.150	0.153	0.023	0.017	0.037	0.011	0.034	0.096	0.065a
Sakha 102 root	0.146	0.152	0.023	0.010	0.031	0.019	0.033	0.110	0.066a
Sakha 103 root	0.149	0.151	0.023	0.010	0.032	0.007	0.032	0.110	0.064a
Sakha 104 root	0.171	0.149	0.034	0.010	0.035	0.006	0.035	0.118	0.070a
Giza 177 root	0.166	0.159	0.035	0.010	0.024	0.006	0.033	0.120	0.069a
Giza 178 root	0.152	0.156	0.028	0.020	0.025	0.005	0.033	0.109	0.066a
Sakha 101 leaves	0.090	0.172	0.000	0.007	0.031	0.010	0.000	0.120	0.054a
Sakha 102 leaves	0.090	0.149	0.030	0.000	0.032	0.012	0.000	0.097	0.051a
Sakha 103 leaves	0.105	0.149	0.000	0.000	0.030	0.011	0.000	0.096	0.049a
Sakha 104 leaves	0.053	0.150	0.000	0.000	0.031	0.011	0.000	0.100	0.043a
Giza 177 leaves	0.049	0.182	0.000	0.000	0.032	0.012	0.000	0.110	0.048a
Giza 178 leaves	0.119	0.208	0.000	0.004	0.031	0.011	0.000	0.108	0.060a
Sakha 101 steam	0.171	0.163	0.000	0.004	0.029	0.010	0.016	0.080	0.059a
Sakha 102 steam	0.175	0.153	0.030	0.005	0.029	0.014	0.031	0.088	0.066a
Sakha 103 steam	0.148	0.186	0.000	0.015	0.055	0.010	0.000	0.085	0.062a
Sakha 104 steam	0.173	0.214	0.000	0.000	0.031	0.010	0.029	0.093	0.069a
Giza 177 steam	0.177	0.158	0.000	0.004	0.032	0.012	0.000	0.103	0.061a
Giza 178 steam	0.182	0.115	0.032	0.000	0.030	0.012	0.000	0.100	0.059a
Total mean	0.139c	0.163d	0.016a	0.008a	0.032a	0.011a	0.017a	0.103b	

Table 5: Allelopathic effect of flowering stage aqueous extract from different rice species on germination of some weeds and crops

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	20.00	20.00	20.00	15.33	19.33	15.33	26.33	20.00	19.54j
Sakha 101 root	20.00	17.30	20.00	12.67	18.67	13.33	16.00	20.00	17.25i
Sakha 102 root	20.00	17.00	20.00	9.33	19.33	8.67	17.67	20.00	16.50h
Sakha 103 root	20.00	17.33	20.00	13.33	17.50	6.67	17.00	20.00	16.48efg
Sakha 104 root	20.00	10.00	18.67	7.33	11.33	11.00	18.00	20.00	14.54bcde
Giza 177 root	20.00	15.00	20.00	9.33	12.67	4.67	16.00	20.00	14.71defg
Giza 178 root	20.00	14.67	20.00	9.33	17.33	4.00	14.33	20.00	14.96cdef
Sakha 101 leaves	20.00	10.67	18.67	10.00	16.33	8.67	13.67	20.00	14.75bcde
Sakha 102 leaves	20.00	8.00	17.33	11.33	18.00	5.33	17.33	20.00	14.67bcde
Sakha 103 leaves	20.00	8.33	17.00	11.33	18.00	4.67	13.67	20.00	14.13a
Sakha 104 leaves	20.00	12.00	17.00	9.33	18.67	4.67	14.33	20.00	14.50bc
Giza 177 leaves	20.00	11.33	17.00	10.67	14.67	6.67	16.67	20.00	14.63b
Giza 178 leaves	20.00	11.33	15.00	8.67	19.00	4.00	16.33	20.00	14.29bcd
Sakha 101 steam	20.00	14.67	20.00	13.33	19.33	4.00	20.00	20.00	16.42fgh
Sakha 102 steam	20.00	11.33	20.00	9.33	19.00	4.00	20.00	20.00	15.46efg
Sakha 103 steam	20.00	12.00	20.00	12.67	19.00	4.00	20.00	20.00	15.96bcdef
Sakha 104 steam	20.00	12.00	20.00	12.67	18.67	5.33	20.00	20.00	16.08gh
Giza 177 steam	20.00	13.33	20.00	11.33	19.33	4.00	20.00	20.00	16.00gh
Giza 178 steam	20.00	11.33	14.67	11.33	19.33	5.33	20.00	20.00	15.25bcde
Total mean	20.00f	13.03d	18.70e	10.98b	17.66e	6.54a	17.75d	20.00f	

rice (*O. sativa* L.) cultivars. Chung *et al.*(2003), said thad the straw extract of some rice varieties had a higher inhibitory effect than hull and leaf extract Chung *et al.* (2002) showed that, the isolated phenolic acids, such as ferulic and p-hydroxybenzoic acids were biologically active by inhibiting barnyardgrass seed germination and seedling growth. They suggested that the allelopathic effects on barnyardgrass may be partly due to the presence of these phenolic acids, with concentrations varying between cultivars.

On the other hand, syringic acid had the lowest concentration 0.148, 0.323 and 0.030 mg/g in Sakha101straw, Sakha103straw and Yasmin hull, respectively. However, in general the descending order of all components concentrations was as follows: ferulic, o-hydroxyphenyl acetic, m-coumaric, syringic acid in all samples.

Rice body parts may a source of natural herbicides, and also on barnyargrass and jungle rice. In the future, we might be developing rice varieties with high allelopathic potential, Chung *et al.* (2003). This study suggested that, the allelopathic compounds present in rice hulls and straw may serve as a potential natural herbicide by inhibiting seed germination and growth of barnyargrass and jungle rice, which became a problem because of increasing use of direct seeding of rice to reduce production cost. If these compounds are used to contribute to the control of barnyargrass and jungle

Table 6: Allelopathic effect of flowering stage aqueous extract from different rice species on some weeds and crops fresh weight (g)

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	0.177	0.170	0.041	0.028	0.023	0.020	0.048	0.111	0.077a
Sakha 101 root	0.162	0.173	0.029	0.021	0.013	0.012	0.035	0.110	0.069a
Sakha 102 root	0.178	0.175	0.041	0.021	0.015	0.015	0.046	0.100	0.074a
Sakha 103 root	0.103	0.157	0.034	0.027	0.016	0.010	0.065	0.100	0.064a
Sakha 104 root	0.171	0.146	0.031	0.015	0.006	0.016	0.046	0.110	0.068a
Giza 177 root	0.152	0.179	0.043	0.035	0.006	0.013	0.063	0.107	0.075a
Giza 178 root	0.167	0.160	0.044	0.030	0.017	0.015	0.041	0.107	0.073a
Sakha 101 leaves	0.200	0.129	0.031	0.024	0.014	0.010	0.028	0.110	0.068a
Sakha 102 leaves	0.201	0.123	0.041	0.025	0.018	0.011	0.045	0.110	0.072a
Sakha 103 leaves	0.241	0.123	0.022	0.024	0.018	0.011	0.038	0.108	0.073a
Sakha 104 leaves	0.227	0.137	0.031	0.022	0.013	0.011	0.033	0.109	0.073a
Giza 177 leaves	0.214	0.125	0.028	0.021	0.014	0.009	0.061	0.107	0.072a
Giza 178 leaves	0.244	0.122	0.039	0.015	0.020	0.009	0.063	0.109	0.078a
Sakha 101 steam	0.171	0.165	0.026	0.020	0.017	0.009	0.033	0.110	0.069a
Sakha 102 steam	0.189	0.166	0.043	0.016	0.021	0.010	0.079	0.110	0.079a
Sakha 103 steam	0.192	0.140	0.020	0.015	0.021	0.010	0.035	0.110	0.068a
Sakha 104 steam	0.183	0.134	0.041	0.017	0.022	0.008	0.028	0.109	0.068a
Giza 177 steam	0.183	0.138	0.040	0.016	0.019	0.011	0.031	0.106	0.068a
Giza 178 steam	0.180	0.150	0.035	0.014	0.020	0.009	0.026	0.107	0.068a
Total mean	0.186g	0.148f	0.035c	0.021b	0.016ab	0.012a	0.044d	0.108e	

Table 7 : Allelopathic effect of straw aqueous extract from different rice species on germination of some weeds and crops

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	20.00	20.00	20.00	15.33	19.33	15.33	26.33	20.00	19.54c
Sakha 101	20.00	20.00	19.33	8.33	10.00	8.67	8.67	20.00	14.38a
Sakha 102	20.00	20.00	18.00	8.67	13.33	11.66	8.00	20.00	14.96b
Sakha 103	20.00	20.00	18.00	11.67	11.00	11.00	7.33	20.00	14.88b
Sakha 104	20.00	20.00	20.00	11.33	14.33	9.33	9.33	20.00	15.54b
Giza 177	20.00	20.00	20.00	12.00	13.00	8.67	9.33	20.00	15.38b
Giza 178	20.00	20.00	18.50	13.33	14.67	11.00	10.00	20.00	15.94b
Total mean	20.00c	20.00c	19.12c	11.52a	13.67b	10.81a	11.28a	20.00c	

Table 8: Allelopathic effect of straw aqueous extract from different rice species on some weeds and crops fresh weight (g)

Treatments	*Brassica niger*	*Hardeum vulgare*	*phalaris minor*	*Lactuca sativa*	*Echinichloa crass-galli*	*Echinichloa colonum*	*Portulaca oleracea*	*Oryza sativa*	Total mean
Water	0.177	0.170	0.041	0.028	0.023	0.020	0.048	0.111	0.077c
Sakha 101	0.029	0.190	0.020	0.014	0.016	0.008	0.017	0.113	0.051a
Sakha 102	0.163	0.206	0.028	0.017	0.019	0.010	0.000	0.111	0.069c
Sakha 103	0.076	0.207	0.026	0.018	0.018	0.010	0.016	0.111	0.060b
Sakha 104	0.129	0.210	0.036	0.018	0.017	0.008	0.016	0.108	0.068ab
Giza 177	0.169	0.203	0.032	0.016	0.014	0.013	0.015	0.117	0.072c
Giza 178	0.156	0.206	0.026	0.018	0.020	0.013	0.012	0.110	0.070c
Total mean	0.128d	0.199e	0.030b	0.018a	0.018a	0.012a	0.018a	0.112c	

Table 9: Retention times and concentration of nine phenolic derivatives compounds detected by HPLC from three rice cultivars hull and straw extracts

Phenolic derivatives compounds	Standard retention time (min)	Sample retention time (min)			Concentration (mg/g)		
		A	B	C	A	B	C
Salicylic acid	24.7	N.D	N.D	N.D	N.D	N.D	N.D
p-Coumaric acid	27.8	N.D	N.D	N.D	N.D	N.D	N.D
o-Hydroxyphenylacetic acid	30.4	30.5	30.4	30.5	3.424	2.822	1.781
Syringic acid	36.6	36.6	36.5	36.5	0.148	0.323	0.030
Ferulic acid	41.1	41.0	40.9	41.1	4.826	5.401	2.097
Benzoic acid	42.6	N.D	N.D	N.D	N.D	N.D	N.D
p-Hydroxybenzoic acid	46.7	N.D	N.D	N.D	N.D	N.D	N.D
m-Coumaric acid	54.3	54.3	54.4	54.4	1.193	0.964	0.066
o-Coumaric acid	62.4	N.D	N.D	N.D	N.D	N.D	N.D

A= Sakha101straw, B= Sakha103straw, C= Yassmin hull and N.D= not detected

rice, they may also used as genetic markers to identify allelopathic varieties by analyzing hull and straw before sawing rice seeds to the field

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الملخص العربى

التأثير الاليلوباثى للمستخلصات المائيه للعديد من أصناف الأرز على بعض الحشائش والتعرف علي بعض هذه المركبات وتقديرها

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فى تجربة معملية لمعرفة التأثير الاليلوباثى كمبيدات حشائش للمستخلصات النباتية لـ ٨ أصناف من الأرز المصرى وهى (سخا ١٠١ – سخا ١٠٢– سخا ١٠٣– سخا ١٠٤– جيزة ١٧٧–جيزة١٧٨– جيزة ١٨٢ وكذلك الصنف ياسمين) وكانت الأجزاء النباتية هى الأوراق– السيقان– الجذور فى أطوار النمو المختلفة (طور الـ ٦– أوراق وطور التزهير بالاضافة إلى القش وقشر الحبوب.) وذلك على إنبات بذور العديد من الحشائش والمحاصيل الشتوية والصيفية العريضة والرفيعة وهى (الكبر– الشعير– حشيشة الكنارى– الخس– الدنيبة– أبوركبة– الرجلة وكذلك صنف الأرز جيزة ١٠١). وقد تم التعرف على هذه المركبات الفعالة فى ٣ أصناف وهى قش الصنف سخا ١٠١ وسخا ١٠٣ وكذلك من قشور حبوب الصنف ياسمين وذلك بإستخدام جهاز الـ HPLC.

وقد أظهرت النتائج أن مستخلص القشر لصنف الارز ياسمين أعطى أعلى تثبيط لإنبات كل النباتات المختبرة دون فرق معنوى وخاصة حشيشة الكبر حيث أعطى (٦٦,٦٥% نقص فى نسبة الإنبات بالمقارنه بالكنترول) وكذلك وزنها الرطب(٢٣,٧٢% نقص فى نسبة الإنبات بالمقارنة بالكنترول). كذلك المستخلص المائي للصنف سخا ١٠٣ فى طور ٦ ورقات وكذلك طور التزهير أعطى أعلى تثبيط لجميع الحشائش يليه سخا ١٠٤ وجيزة ١٧٧. وقد كان نبات الخس أكثر النباتات تأثرا بالمستخلصات المائيه للأصناف الأرز وذلك فى مرحلة ٦ أوراق يليه حشيشة أبوركبة.

ولقد اوضحت النتائج أيضا أن حشيشة الدنيبة أكثر النباتات تأثرا بالمستخلصات المائية فى طور التزهير. وقد أظهر التحليل الاحصائى أن المستخلص المائى لقش سخا ١٠١ وسخا ١٠٢ وسخا ١٠٣ أكثر المستخلصات تأثيرا على النباتات المختبرة يليها جيزة ١٧٧ وسخا ١٠٤.

وأظهرت نتائج تحليل الـ HPLC أنه تم التعرف على أربعة مركبات هى حامض الفيريوليك – ارثو هيدروكسى فينيل اسيتات – ميتا كيوماريك اسيد – سيرينجيك وكان الفيريوليك أكثر المركبات تواجدا فى مستخلص القش للأصناف سخا ١٠١وسخا ١٠٣ وكذلك الصنف ياسمين وكان تركيزه فى هذه الأصناف بالترتيب كالاتى: ٤,٨٢٦ و ٥,٤٠١ و ٢,٠٩٧ مليجرام/ جم من النبات .

وتعتبر هذه الدراسة خطوة لتقدير المركبات ذات التأثير الاليلوباثى لأصناف الأرز المصرية التى أظهرت مستخلصاتها المائية من العديد من الأجزاء النباتية تأثير ابادى كمبيدات حشائش.

ومن خلال هذه الدراسة يمكن لهذه المركبات والموجودة فى قش وقشر الارز لبعض الاصناف يمكن أن تستخدم كمبيدات حشائش طبيعية لحشيشة ابوركبة والتى تمثل أكبر مشاكل الأرز البدار والذى تزايد انتاجه نظرا لانه يقلل من تكلفة المحصول وبالتالى يمكن أن نجعلها تتحلل فى الحقل قبل بدار الأرز لمنع إنبات هذه الحشائش. وكذلك يمكن إستخدام القش والقشر للتحلل فى الحقول قبل المحاصيل الشتوية بدلا من حرقها.