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Crop-weed Association in Different Field Crops at Sirajganj District in Bangladesh

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ABSTRACT

A survey was conducted at farmers' fields in five upazilas of Sirajganj district to find out farmers' knowledge on crop-weed association in different field crops, crop yield losses and weeds act as alternate hosts for insect-pathogen during 2019 to 2020 cropping seasons. Primary data were collected from the respondents through a well-oriented structural questionnaire. A total of 40 weed species, belong to 35 genera under 21 families, were identified from 8 different field crops. The highest crop-weed association was found in rice (40:192) and the lowest in mustard (106:50). The maximum weed management cost was occurred in rice (38,900 Tk. ha^{-1}). Weed caused 8 to 51% yield loss in different field crops. Our results revealed that Mutha emerged as the major noxious weed for five field crops of this district. Weeds acted as alternate hosts of various insects and pathogens. According to farmers' opinion, weed is also used as fodder, mulch, compost, vegetables, fish feed, medicinal and ornamental purposes at their locality. Therefore, the present study provides information to extension workers and researchers about the noxious weeds and their crop-weed association, other harmful and beneficial effects of weeds, for better, sustainable, and eco-friendly weed management practices.

Introduction

A weed is defined as any plant that is a hazard, nuisance or causes injury to man, animals or desired crops (Ferrell *et al*., 2008). From the definition, any plant can be considered a weed under certain circumstances. Dissemination and persistence of weeds varied from place to place on the earth. The interaction or relationship between a weed and another plant depends on its existing environment. In the past, the understanding of weed ecology was neglected in weed management, although the ecology of weed species could be one of the most important tools to determining the correct course of action. Weed characteristics and classification are some of the basic aspects of weed ecology. The characteristics of plants that support weediness include rapid seed germination, rapid growth, the ability to take up and utilize large amounts of nutrients, prolific seed production, seed characteristics that promote dispersal, seed dormancy mechanisms, continual flashes of germination, the ability to adapt of various environmental conditions, and high tolerance to stresses (Schwartz and Gage, 2017). These growth characteristics and adaptations enable them to successfully exploit the numerous ecological niches left unoccupied by crop cultures. Weeds compete with crop plants and among themselves as well. Among the more important adaptations relevant to competitive advantage are properly synchronized germination and rapid establishment. Moreover, growth of seedlings, tolerance to shading effects by the crop or by other weeds at the time of establishment. However, quick response to available soil moisture and nutrients, adaptation to the most severe climatic situations of the habitat. In the initial stages of an invasion by weeds exposed ecological niches, only very limited competition for resources by the crop.

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And weed may occur as the establishment of the crop-weed association is completed; competition for the available resources is more obvious.

Weed can directly affect the prosperity of helpful insects, including predators, parasitoids, and pollinators (Showler and Greenberg, 2003; Al-Doghairi and Cranshaw, 2004). Some insects like cutworms show complexities among the insect–weed–crop plant communication (Capinera, 2005). Insects have a broad crowd variety; they sometimes shift from weeds to crop plants and causing crop damage. Weeds capable to interact with pathogen management in numerous habits including the provision of weed biological control. Parasitic weeds can straight serve up as vectors or hosts for plant pathogen. The importance of weeds as a refuge for entomo-pathogenic diseases is relatively understudied (Capinera, 2005). Only about one-third of the orders of insects and about 45% of insect species feed on living plants (Strong *et al*., 1984). Weeds, however, often harbour diseases that can be transferred to crop plants by insects feeding first on weeds than on the crop (Chellemi *et al*., 1994); it may be made necessary exchange hosts for several pathogens (Wisler and Norris, 2005). The helpful effects of weeds on insect pathogens in distant overshadowed, however, by the negative consequence of weeds on diseases. Many insects *viz*. aphid, thrips, whitefly, and leafhoppers, are usually transmitted plant diseases from weeds (Capinera, 2005).

Although, weeds have a negative association; these show a large of compensation or give out other indirect rationales of great significance. It is also used as leafy vegetables; dissimilar weeds afford a vegetative cover-up/mulching, feed/fodder for animals, fish feed, adds organic matter, manage nutrient cycling, vegetables, medicinal purpose and beautification of the landscapes, serves as a significant genetic resource (Sagar *et al.*, 2018; Khatun *et al*., 2019; Mia *et al.*, 2020). Weeds are estimated to cause more than $40 billion in annual global losses through degraded agricultural and silvicultural productivity (Kashem *et al*., 2009). It reduced access to land and water, impaired aesthetics, and disruption of human activities and well-being. The yield loss due to unchecked weeds varies from 25–80% and it depended on the types of crops (Kashem *et al*., 2009). In the case of rice, severe weed infestation reduces the grain yield by 70–80% in Aus rice, 30–40% for transplanted Aman rice, and 22–36% for modern Boro rice cultivation in Bangladesh (Mamun, 1990). Weed infestation reduces grain yield by 59.82% (Sinha *et al*., 2018) and 28.16% (Zannat *et al*., 2014) in aromatic rice at Boro and Aman seasons, respectively. In Bangladesh, there is less attention in research on weed and weed management than in other countries (Kashem *et al*., 2009).

The present study was undertaken to farmers' field survey on crop-weed association in different field crops and insect-disease use weed as alternate host and other uses of weeds in five upazilas of Sirajganj district.

Materials and Methods

Study area

The study area was selected in Sirajganj district, the gateway of North Bengal of Bangladesh. The Sirajganj district occupies 2497.92 sq. km. area and located between latitudes $24^0 01^/$ to $24^0 47^/$ N and longitudes $89^0 15^/$ to $89^0 59^/$ E. It has an average elevation of 7m. The average maximum and minimum temperature range from 35.5^0C (March) to 11°C (January), respectively, and total rainfall of 12967 mm in the year 2020. The district consists of nine upazilas and five upazilas *viz*. Siraganj Sadar, Kazipur, Ullapara, Shahjadpur, and Tarash, were selected for the study purpose.

Sampling period and method

Thirty farmers were selected from each upazilas (30 × 5=150) and the study area was made by the suggestions of the local sub-assistant agricultural officer. Sampling was done during *Kharif-1* (Mid March to Mid July), *Kharif-2* (Mid July to Mid October), and *Rabi* (Mid October to Mid March) cropping season of 2019 to 2020. It was found the various taxonomic group and population dynamics of different weed species in eight field crops *viz*. rice, wheat, jute, maize, sugarcane, mustard, lentil and chili. The weed survey was made by the least count quadrate method (Misra, 1968) using 1.0 m × 1.0 m quadrate. In each crop field, 3 quadrates were laid down and the number of crops and each weed species in quadrate was recorded. The collected weed samples (fresh or dried) were identified in the field or by comparing with "Encyclopedia of Flora and Fauna of Bangladesh" (Ahmed *et al*., 2008–9) and other taxonomy-related books. In the crop fields, notes were written on habitat, habit, flower colour and shape, seed colour and shape as well as general distribution. The data was gathered from the field regarding the local names of the weeds.

Farmers' opinion

Farmers' activities information were collected on weed management practices, weeding frequency, cost of weeding, and yield loss due to weeds. Data were collected personally from the respondents through a well-developed pre-tested structured questionnaire for the study purpose. Data was also collected on farmers' knowledge in crop weed association, noxious weed identification, weed insect and pathogens association as well as the use of weed for different purposes.

Results and Discussion

A total of 40 weed species, belong to 35 genera under 21 families, were collected from 5 upzilas of Sirajganj district during *Kharif-1*, *Kharif-2* and *Rabi* cropping season of 2019 to 2020 (Table 1). Poaceae (conserved name Gramineae) was the most species-rich family with 8 species followed by Cyperaceae with 5 species; all together they constituted more than one-third of the total weed species identified (Table 1). Among the genera, *Cyperus* was the most species-rich genus represented by three species; *Amaranthus*, *Euphorbia* and *Echinochloa* were represented by two species each. Monocots occupy about 25% of the world's weed flora (Bryson and Carter, 2008). Kabir *et al*. (2014) reported that the Poaceae contributed to the highest number of weed species than other families in the wheat crop. According to growth habit, 24 species were annual, 12 perennials, and 4 both annual and perennial. These species were herbaceous, branched, leaf blade broad or narrow, bushy, propagated by stem, rhizome and seed as well. Kabir *et al*. (2014) also observed that the broadleaf weed was dominant over grasses and sedges in Mymensingh. An equal number of both major and minor weeds (20 species each) were observed in the surveyed area (Table 1).

Surveyed (eight) crops were associated with 40 weeds during *Kharif-1*, *Kharif-2* and *Rabi* cropping season (Table 2). Although the number of infested weed taxa (7 – 9) was comparatively lower, the highest crop weed ratio was found in rice crops (Aus rice > Boro rice > Aman Rice) followed by chili. On contrary, the number of infested weed taxa (14) was the highest; however, the crop weed ratio was the lowest one in mustard crop fields. It might be due to the wetland crop field more suitable for weed growth. The highest weed management cost was required for Boro rice (38,900 Tk. ha^{-1}) and the lowest in Lentil (8,892 Tk. ha^{-1}) (Table 2). In rice, weed management costs comparatively higher than other field crops due to higher weed infestation in wet culture. *Rabi* crops were cultivated in the dry season and it was comparatively easy to control weeds thus lower the management cost. So, weed management in *Rabi* crops was more cost-effective than *Kharif* season cultivated crops (Table 2). Weed occurred yield loss from 8 to 51% in different field crops (Table 2). The highest yield losses were found in rice crop (Aus rice by 35–51%, Aman rice by 23–33%, and Boro rice by 38–47%) followed by jute (33–45%) and wheat (25–31%) while the lowest one was found in chili by 8–12% due to less weed infestation (Table 2). That means rice is the most competitive crop than other field crops where chili is the least competitive crop against weeds. Crop losses depend on the type of crops was confirmed by Karim *et al*. (1998) who noticed that production losses may occur due to weeds as 33.2% in food crops, 41.3% in cereals, 31.9% pulses, 40.8% in oilseeds, 34.2% in fibre crops and 40.3% in rice crops in Bangladesh. Weed crop interference and subsequently crop yield losses might be varied due to agro-ecological influence so wheat yield loss up to 25–30% in Pakistan (Nayyar *et al*., 1994), 20–40% in India (Mishra, 1997), and 33% in Bangladesh (Karim, 1987). Kashem *et al*. (2009) reported that the yield loss due to unchecked weeds varied from 25-80% and it varied with types of crops.

In the rice field, a total of 12 weeds were observed in surveyed area and among them, Shama (*Echinochloa crusgalli*) was the most trouble one than others weeds (Table 3). Ten weeds were observed in the wheat field and Bathua (*Chenopodium album*) was a major problematic weed. Rahman (1985) observed that the most abundant weed species is *Chenopodium album* and it contributed 56.5% of total weed vegetation in a wheat field. Seven weeds were associated with the jute crop and Khude shama (*Echinochloa colona*) was the most disturbance one than others weed. Twelve weeds were collected from the maize field and Mutha (*Cyperus rotundus*) was the most dominant weed than the others (Table 3). Sugarcane is a long-term field crop and it was associated with 11 weeds and Mutha was the chief disturbing weed in growing crop than other weeds. In the mustard field crop, the highest number of weeds (14) was found and Mutha was a major problem weed. Ten weeds were found in the lentil field and Mutha was the most prominent one than other weeds. Chili crop associated with 11 weeds and Mutha was most virulent weed comparatively others (Table 3). It was observed that Mutha was the most dangerous weed which may occur an adverse effect on crop growth and yield. Mutha is also one of the obnoxious weeds worldwide (Bryson and Carter, 2008).

Weeds were used as an alternative host plant by many insects. Cutworm insects were found in Mutha and Ghagra (*Xanthium strumarium*) (Table 4). Durba (*Cynodon dactylon*) and Chapra (*Eleusine indica*) were alternate host of white beetle. Short-horned grasshopper, long-horned grasshopper, jute hairy caterpillar were found in Shama and Arail (*Leersia hexandra*). On the other hand, green leafhopper, brown plant hopper and stem borer insect were taken place in Mutha, Shama, and Goicha (*Paspalum scrobiculatum*) as used alternate host of rice crop (Table 4). Aphid, mite, thrips, and fruit borer were found in Tit begun (*Solanum torvum*) and Foska begun (*Physalis heterophylla*) instead of the bean, mustard and Solanaceae crops. Islam (2014) reported that *Cynodon dactylon*, *Chenopodium album*, and *Solanum nigrum* serve as alternate hosts of aphids. Fall armyworms were found in Durba and Mutha weeds in absence of maize crop (Table 4).

Eicchornia crassipes and *Amaranthus* sp. were detected as alternate hosts of *Spodoptera litara* Fab. (Islam, 2014). Whitefly laid eggs in Bathua, Durba and Kakpaya (*Dactyloctenium aegyptium*) were acted as alternate hosts of rice and wheat crops (Table 4). Islam (2014) also reported that *Triumletta rhomboidey* and *Leucas aspara* acted as alternate hosts of jute Apion (*Apion corchori* Marsh). *Ageratum conyzoides* and *Heliotropium indicum* act as alternate hosts of jute hairy caterpillar (*Diacrisia oblique* Walker). However, weeds not only harbouring insects but also the good harbour of fungus and bacteria that cause disease to field crops (Talukder and Waseque, 1978). Sheath rot, stem rot, sheath blight, and blast were the major diseases of rice crops and Shama and Mutha were act as the alternate hosts of rice and wheat crops (Table 5). Tosiah *et al*. (2009) surveyed native fungal pathogen on Shama in Malaysia and found 12 fungal genera. On the other hand, Chunchi (*Alternanthera sessilis*), Shak notey (*Amaranthus viridis*), Kata notey (*Amaranthus spinosus*) and Bathua weeds were used as the alternate hosts of stem rot, blight, leaf spot and rust diseases of wheat and maize crop. Some fungal organisms found in Bathua were listed by Bassett and Crompton (1978). Anthracnose disease-causing agent used Bon Marich (*Croton bonplandianus*) as alternate host in absence of Solanaceae crop. Bon Shorisha (*Brassica kaber*) was used in an alternate host of the blight of mustard and pulse crop (Table 5). Wisler and Norris (2005) reported that weed can significantly influence disease incidence and spread because as a pest it acts as a vector of a pathogen, reservoir of pathogen or its vector.

Despite many disadvantages, Durba, Goicha, Shama, Arail, Mutha, Kata notey, Shak notey, Helencha (*Enydra fluctuans*), Amrul (*Oxalis corniculata*), and Shushni were used as fodder for animal rearing (Table 6). Kochuripana (water hyacinth) and Arail were used as mulching materials in the different vegetable fields. Kochuripana, Shama, Goicha were the cheapest raw materials of compost preparation and these weeds were associated with the Aman rice field (Table 6). Bathua, Kata notey, Shak notey, Helencha, Amrul, Shushni, Chanchi were potable as green vegetables associated with rice, wheat, jute, sugarcane, lentil, and mustard crops (Table 6). The edible parts of weedy vegetables were shoots, leaves, stalks, stems flower fruit and seed as well. Cruz-Garcia and Price (2012) reported that the weedy vegetables were considered on edible parts of both reproductive (flowers, fruits and seeds) and vegetative organs (shoots, leaves, flower stalks, stems or the whole aerial part) and important resource for the multiple additional uses of medicine. A different weed has medicinal value *viz*. Durba, Biskatali (*Polygonum hydropiper*), Thankuni (*Centella asiatica*), etc. and associated with rice, maize, wheat, jute, sugarcane, lentil and mustard. Khatun *et al*. (2019) studied indifferent 107 weeds and reported that weed plants have medicinal value, consumed as vegetables, feed, fodder, and other uses. Our country people were used Khudepana, Kochuripana, Amrul, Shushni, Helencha as fish feed and associated with rice, wheat, jute, sugarcane, lentil, mustard. In lawn, garden, different tourist places and office yard were designed with chapra and durba grasses to ornamental purpose and those were associated with rice, wheat, jute, sugarcane, lentil and mustard (Table 6). Nagori and Solanki (2011) stated that durba is used as loan grass, roadsides and can readily take possession of any uncultivated area.

Table 1. List of weed species in the study area during three cropping seasons

Bangla name	English name	Scientific name	Family	Brief morphology and habitat	Status
Kata notey	Spiny pigweed	*Amaranthus spinosus* L.	Amaranthaceae	Annual, herbaceous, branchy, spiny stem, propagation – seed	Major
Shak notey	Pigweed	*Amaranthus viridis* L.	Amaranthaceae	Annual, herbaceous, branchy, no spine, propagation – seed	Major
Chanchi	Sessilis	*Alternanthera sessilis* (L.) R.Br. *ex* DC.	Amaranthaceae	Perennial, ball inflorescence, branched stem, propagation – seed	Minor
Thankuni	Asian pennywort	*Centella asiatica* (L.) Urb.	Apiaceae	Perennial, kidney like leaves with waved edge, propagation – seed	Minor
Khudepana	Duckweed	*Lemna minor* L.	Araceae	Floating freshwater aquatic plant, propagation – mainly vegetative	Minor
Helencha	Common enydra	*Enydra fluctuans* Lour.	Asteraceae	Annual, swell and long internode, propagation – seed	Minor
Saglagachha	Goat weed	*Ageratum conyzoides* (L.) L.	Asteraceae	Annual, herbaceous, tube like stem, hairy, propagation – seed	Minor
Keshoti	False daisy	*Eclipta prostrata* (L.) L.	Asteraceae	Annual/perennial, herbaceous, reddish black stem, propagation – seed	Minor
Bon sorisha	Wild mustard	*Brassica kaber* (DC.) L.C. Wheeler	Brassicaceae	Annual, fruit siliqua, propagation – seed	Minor
Contune					

Table 1. List of weed species in the study area during three cropping seasons (continued)

Bangla name	English name	Scientific name	Family	Brief morphology and habitat	Status
Bathua	Lambs quarter	*Chenopodium album* L.	Chenopodiaceae	Annual, herbaceous, pale green stem, propagation – seed	Major
Kanainala	Kanainala	*Cyanotis axillaris* (L.) D. Don *ex* Sweet	Commelinaceae	Annual, fleshy stem, stem covered by sword-like leaf coat, propagation – seed	Minor
Ghagra	Rough cocklebur	*Xanthium strumarium* L.	Compositae	Annual, herbaceous, stem terete, propagation – seed	Minor
Shetolumi	Cudweed	*Laphangium luteoalbum* (L.) Tzvelev	Compositae	Annual, herbaceous, variably woolly or cottony; stem tall, diffusely branched; propagation – seed	Minor
Holdemutha	Yellow nutsedge	*Cyperus difformis* L.	Cyperaceae	Perennial, propagation – seed, rhizome and tuber	Major
Borochucha	Umbrella sedge	*Cyperus iria* L.	Cyperaceae	Perennial, pseudo-stem, herbaceous, propagation – seed, rhizome and tuber	Major
Mutha	Nutsedge	*Cyperus rotundus* L.	Cyperaceae	Perennial, pseudostem, herbaceous, propagation – seed, rhizome, tuber and stolon	Major
Joyna	Joyna	*Fimbristylis miliacea* (L.) Vahl.	Cyperaceae	Annual/Perennial, umbel type inflorescence, propagation – seed	Major
Chechra	Bog bulrush	*Schoenoplectiella mucronata* (L.) J. Jung & H.K.Choi	Cyperaceae	Annual sedge, leaf round, propagation – seed	Major
Boro dudhia	Garden spurge	*Euphorbia hitra* L.	Euphorbiaceae	Annual, creeper, herbaceous, exude milky white substance due to injury, propagation – seed	Minor
Chhoto dudhia	Prostate spurge	*Euphorbia thymifolia* L.	Euphorbiaceae	Annual, creeper, herbaceous, exude milky white substance due to injury, propagation – seed	Minor
Bon morich	Croton	*Croton bonplandianus* Baill.	Euphorbiaceae	Annual, branched, triangular capsule type fruit, propagation – seed	Minor
Durba	Bermuda grass	*Cynodon dactylon* (L.) Pers.	Poaceae	Perennial, herbaceous, creeper, propagation – seed, rhizome and stolon	Minor
Kakpaya	Crowfoot weed	*Dactyloctenium aegyptium* (L.) Willd.	Poaceae	Perennial, bushy, root system fibrous, propagation – seed	Major
Anguli	Scrab grass	*Digitaria sanguinalis* (L.) Scop.	Poaceae	Annual, herbaceous, branched stem, spiky inflorescence propagation – seed	Major
Khude shama	Jungle rice	*Echinochloa colona* (L.) Link	Poaceae	Annual, herbaceous, strong stem, propagation – seed, rhizome and stolon	Major
Shama	Barnyard grass	*Echinochloa crusgalli* (L.) P. Beauv.	Poaceae	Annual, herbaceous, strong stem, propagation – seed, rhizome and stolon	Major
Chapra	Goosegrass	*Eleusine indica* (L.) Gaertn.	Poaceae	Perennial, bushy, propagation – seed	Major
Arail	Swamp rice	*Leersia hexandra* Sw.	Poaceae	Annual or perennial, branched, propagation – seed	Major
Goicha	Paspalum grass	*Paspalum scrobiculatum* L.	Poaceae	Annual, leaf blade narrow, stem straight, propagation – seed	Major
Shetodron	Leucas	*Leucas aspera* (Willd) Link.	Lamiaceae	Annual, few branchy, tetra-angular, propagation – seed	Minor
Khetpapri	Lindernia	*Lindernia procumbens* (Krock) Philcox	Linderniaceae	Annual/perennial, erect, stem slender, propagation – seed	Major
Shushni	Four leaf clover	*Marsilea quadrifolia* L.	Marsileaceae	Perennial, stolon like stem, propagation – seed	Major
Orobanche	Broomrape	*Orobanche* sp.	Orobanchaceae	Annual, propagation – seed	Major
Amrul	Indian sorrel	*Oxalis corniculata* L.	Oxalidaceae	Annual, herbaceous, 3 heart like leaflets, pentangular fruit, propagation – seed	Major
Bishkathali	Smart weed	*Polygonum hydropiper* L.	Polygonaceae	Annual, herbaceous, reddish-black stem, propagation – seed	Minor
Choto Panikochu	Small water colocasia	*Monochoria vaginalis* (Burm.f.) C. Presl.	Pontederiaceae	Annual/perennial, spongy leaf, rootstock fleshy, propagation – rootstock and seed	Minor
Kochuripana	Water hyacinth	*Eichhornia crassipes* (Mart.) Solms.	Pontederiaceae	Perennial, herbaceous, spongy leaf petiole, propagation – rootstalk, stolon and seed	Minor
Nunia	Common Purslane	*Portulaca oleracea* L.	Portulacaceae	Annual, herbaceous, yellow flower, fleshy leaves, propagation – seed	Minor
Tit begun	Black nightshade	*Solanum torvum* Sw.	Solanaceae	Perennial, branched stem, round fruit, propagation – seed	Major
Foska begun	Foska begun	*Physalis heterophylla* Nees	Solanaceae	Perennial, round fruit, propagation – seed	Minor

Table 2. Crop-weed association and their ratio, management cost and yield loss in different field crops

Name of crops	Associated weeds	Crop: weed m^{-2}	Weed management (ha^{-1})			Yield loss
			Method	Times	Cost (Tk.)	
Aus rice	Shama, durba, goicha, joyna, boro chucha, panikochu, mutha	40:192	Manual+ Chemical	2+1	31,490/-	35-51%
Aman rice	Arail, shama, goicha, panikochu, joyna, khudepana, durba, kochuripana, mutha	38:180	Manual+ Chemical	2+1	34,456/-	23-33%
Boro rice	Shama, goicha, panikochu, khudepana, chechra, durba, chanchi, durba, mutha	35:190	Manual+ Chemical	2+1	38,900/-	38-47%
Wheat	Bathua, durba, nunia, bonkopi, kata notey, bishkathali, mutha, chapra, foska begun, boro dudhia	135:90	Manual	1	14,820/-	25-31%
Jute	Goicha, khude shama, mutha, durba, helencha, chapra, joyna	90:73	Manual	2	29,640/-	33-45%
Maize	Bathua, durba, nunia, bonkopi, shushni, shetodron, kata notey, bishkathali, mutha, chapra, foska begun, boro dudhia	12:75	Manual	2	29,640/-	17-25%
Sugarcane	Shama, mutha, amrul, chhoto dodhia, durba, bishkathali, keshuti, ghagra, chapra, kakpaya	22:80	Manual	2	37,050/-	20-31%
Mustard	Durba, bishkathali, chanchi, bon morich, orobanchi, goicha, bathua, mutha, chapra, helencha, anguli, tit begun, chhoto dudhia, shak notey	106:50	Manual	1	11,115/-	21-28%
Lentil	Kakpaya, durba, mutha, shak notey, chapra, bathua, helencha, chhoto dudhia, ghagra, nunia	77:83	Manual	1	8,892/-	19-26%
Chili	Mutha, khude shama, kata notey, tit begun, bon morich, durba, helencha, goicha, thankuni, kakpaya, chapra	57:133	Manual	2	22,230/-	8-12%

Table 3. Farmers' opinion about degree of harm of various weeds on respective field crops

Noxious weed	Associated crop	Ranks
Shama, durba, goicha, boro chucha, chanchi, panikochu, mutha, arail, khudepana, chechra, kochuripana, joyna	Rice	Shama > goicha> chechra>arail> durba> boro chucha>mutha>joyna> chanchi> khudepana> panikochu>kochuripana
Bathua, durba, nunia, bonkopi, kata notey, bishkathali, mutha, chapra, foska begun, boro dudhia	Wheat	Bathua>mutha>kata notey>durba>nunia>chapra> boro dudhia>bishkathali>foska begun >bonkopi
Goicha, khude shama, mutha, durba, helencha, chapra, joyna	Jute	Khude shama>mutha,>durba>chapra>goicha> helencha> joyna
Bathua, durba, nunia, bonkopi, shushni, shetodron, kata notey, bishkathali, mutha, chapra, foska begun, boro dudhia	Maize	Mutha>chapra>durba>kata notey>nunia>foska begun>boro dudhia>shushni>bathua>bishkathali> shetodron
Shama, mutha, amrul, chhoto dodhia, durba, bishkathali, keshuti, ghagra, chapra, kakpaya	Sugarcane	Mutha>durba,>chapra>kakpaya>shama> ghagra>amrul>chhoto dudhia>keshuti>bishkathali
Durba, bishkathali, chanchi, panimorich, orobanchi, goicha, bathua, mutha, chapra, helencha, anguli, titbegun, shak notey, chhoto dudhia	Mustard	Mutha>durba>orobanchi>chapra>chanchi> helencha>goicha>anguli>chhoto dudhia> shak notey> bishkathali>bathua>panimorich>tit begun
Kakpaya, durba, mutha, shak notey, chapra, bathua, helencha, chhoto dudhia, ghagra, nunia	Lentil	Mutha>durba>chapra>helencha>shak notey> chhotodudhia>kakpaya>nunia>ghagra>bathua
Mutha, khude shama, kata notey, bonmorich, tit begun, durba, helencha, thankuni, kakpaya, goicha, chapra	Chili	Mutha>durba>khude shama>helencha>chapra> thankuni>kata notey>goicha>kakpaya>bon morich> tit begun

Table 4. List of weeds as a host of harmful insects

Name of weeds	Insect host	Associate crops
Ghagra, mutha	Cutworm	Sugarcane, jute, maize
Durba, chapra	Wire beetle	Sugarcane, jute, wheat, lentil
Shama, arail	Short-horned grasshopper, long-horned grasshopper, jute hairy caterpillar	Rice, jute, wheat
Mutha, shama, goicha	Green leafhopper, brown plant hopper, stem borer	Rice, sugarcane
Tit begun, foska begun	Aphid, mite, thrips, fruit borer	Mustard, chili, mustard
Durba, mutha	Fall armyworm	Maize
Bathua, durba, kakpaya	Whitefly	Rice, wheat

Table 5. List of weeds as a host of harmful disease pathogens

Name of weeds	Disease host	Associate crops
Shama, mutha	Sheath rot, stem rot, sheath blight, blast	Rice, wheat, sugarcane
Shunchi, shak notey, kata notey, bathua	Stem rot, blight, leaf spot, rust	Sugarcane, rice, wheat
Bon morich	Anthracnose	Mustard, lentil, chili
Bon shorisha	*Alternaria* blight	Mustard, lentil, chili

Table 6. Economic use of weeds in the study area

Purpose	Name of weeds	Associated crops
Fodder	Durba, goicha, shama, arail, mutha, kata notey, shak notey, helencha, amrul, shushni	Rice, wheat, jute, sugarcane, lentil, mustard
Mulching	Kochuripana, arail	*Aman* rice
Compost/Inputs of organic matter	Kochuripana, shama	*Aman* rice
Vegetables	Bathua, kata notey, shak notey, helencha, shetdron, shushni, chanchi	Rice, wheat, jute, sugarcane, lentil, mustard
Medicinal	Thankuni, shetdron, durba, bishkathali	Rice, wheat, jute, sugarcane, lentil, mustard
Fish feed	Khudepana, kochuripana, amrul, shushni, helencha	Rice, wheat, jute, sugarcane, lentil, mustard
Ornamental	Chapra, durba	Rice, wheat, jute, sugarcane, lentil, mustard

Conclusion

Forty different weeds belong to 35 genera, were observed in association with eight field crops in the surveyed area. The highest weed abundance and maximum yield loss occurred in rice crops due to weed association. Among the weeds, Mutha was the most obnoxious weed and took disturbing in six cultivated field crops. Insects and pathogens used weeds as alternate hosts in absence of field crops. However, weeds have some beneficial effects *viz*. fodder, mulch, compost, vegetables, medicinal value, fish feed, and ornamental purpose in different attractive places. The study will provide knowledge about the most noxious weeds and alternate hosts in the crop fields. Therefore, farmers could decide to control weeds for the economic cultivation of field crops.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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