RESEARCH ARTICLE

Diversity of weeds in maize and soybean crop and their ecological characteristics under the northern climatic scenario of swat Pakistan

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It has been noticed since last decade that weeds emergence, survival, growth and development sharpened as compared to the previous decades and yield of agronomic crops especially of cereals and cash crop drastically decreased. In present study various weeds were observed in consecutive two years study as a test crop on Maize and soybean crop under the agro ecological condition of Swat Pakistan.

Key Words: *Global warming; Climate system; Greenhouse effect*

INTRODUCTION

The regional climate has great importance in respect of agricultural productivity, food security, and livelihood. Field trials were conducted at Agriculture Research Institute Mingora Swat Pakistan during summer 2016 and 2017. All weeds were identified, its biomass and its frequency (m-2) was evaluated [1-4]. The weeds are graphically (pictures) presented here in this study for the purpose to find out its sustainable and environmental friendly control measures to avoid yield losses in various crops and overcome on food security. Weeds found during the whole growing period of maize crop in both seasons were *Portulaca oleracea L., Parthenium hesterphorus L., IPomoea nil L., Erigeron canadensis L., Euphorbia heterophylla L, Phylanthus fraternnus L.*(Webster), *Echinochloa crusgalli L., Asparagus officinalis L., Cynodon dictylon L., Digera muricata L., Cyprus reotendous L.* and *Solanum nigrum L.* The most abundant and flourished weeds were *Cyprus reotendous L,* and *Cynodon dictylon* were observed during the both years experiments. It has been concluded that CO2 concentration may have enhanced in the atmosphere as well as in the soil which favors in weeds growth and development [5,6]. IPCC reports also reflect increase in CO2 concentration in the atmosphere which causes global warming and also its concentration proliferate C4 weeds growth. Reduction in grain yield due to various pests and, in particular, weeds are a common factor in various small and large crops such as cereals, legumes and cash crops [7]. To overcome the yield gap and ensure food security, better crop management practices should be needed to minimize pest losses and increase productivity. In this connection, the present study was conducted to investigate the diversity of weeds in maize and soybean crops, their mode of action (non-parasitic, parasitic or semi-parasitic) and their various species present in the field of maize at the Mingora Swat Pakistan Agricultural Research Institute [8]. The design was based on a Randomized Complete Block Design (RCBD) with three replications. Experimental treatments were used, including three organic sources (Peach leaf and rotten fruit on a dry basis, Peach residue compost and Bio char of these residues), three P rates (P1=50, P2=75, and P3=100 kg P ha-1) with two beneficial microbes (Phosphate solubilizing bacteria and Trichoderma G8 Strain) using Azam Pre-basic maize cultivar [9-11]. The effect of treatment on growth and the development of weeds will be discussed in the next scientific report and its impact on grain yield and yield contributory parameters. Only the diversity of weeds and their ecological characteristics are presented in this report. Weeds found during the whole growing period of maize crop were *Euphorbia heterophylla L, Phylanthus fraternnus L.*(Webster), *Portulaca oleracea L., Parthenium hesterphorus L., IPomoea nil L., Erigeron canadensis L., Echinochloa crusgalli L., Asparagus officinalis L., Cynodon dictylon L., Digera muricata L., Cyprus reotendous L. and Solanum nigrum L.* The most abundant and flourished weeds *Cyprus reotendous L,* and *Cynodon dictylon* were observed during the experiment [12].

Recent studies have showed that plants and crop responded positively to regional climate and showed ameliorating effect in term of grain yield, plant height, thousand grain weight, dry matter portioning, biological yield, oil yield, and quality of the crops. A significant change in the Earth's climate is occurring slowly and gradually and influencing life on the planet earth. Climate can be defined as "expected weather"[13,14]. When changes in the expected weather occur, known as climate changes. They can be defined by the differences between average weather conditions at two separate times. Climate may change in different ways, over different time scales and at different geographical scales. In recent times, scientists have become interested in global warming, due to mankind's impact on the climate system, through the enhancement of the natural greenhouse effect [15]. The Earth is currently getting warmer because people are adding heat-trapping greenhouse gases to the atmosphere. The term "global warming" refers to warmer temperatures, while "climate change" refers to the broader set of changes that go along with warmer temperatures, including changes in weather patterns, the oceans, ice and snow, and ecosystems around the world [16]. The average climate around the world is called global climate. When scientists talk about global climate change, they're talking a pattern of changes happening around the world over many years.

Several factors have an impact on maize growth and yield. The competition between weeds and maize crops for available resources is one of the most important factors [17]. Pakistan's cereal-based crop pattern has been reported as one of the major causes of poor maize yields. This competition is most serious and drastically reduce maize yield at initial crop growth stage. Successful cultivation of maize depends to a large extent on effective weed control for the adequate supply of essential nutrients and soil moisture. Water and fertilizer efficiency are the two most important inputs for high yields and are adversely affected by poor weed control. Severe losses in yields of up to 70% of maize are reported in smallholder farming. Although maize producers face so many economic problems, one of the main concerns is the lack of weed control. Many researchers concluded that several weed species could not be effectively controlled, although many effective herbicides have been developed in recent years [18-20]. This experiment was designed to study the effect of various organic and inorganic fertilizers on maize phenology and weed density.

MATERIALS AND METHODS

Field experiments were conducted at Agriculture Research institute Mingora Swat Pakistan during the summers of 2016 and 2017. Two individual experiments, one on maize and soya, followed by a uniform wheat crop as a subsequent crop and repeated in the following year 2017 [21]. In both experiments, weed diversity and other agronomic parameters were studied. The residual effect of all organic matter was also studied in the wheat crop. The design was based on a randomized complete block design (RCBD) with three replications [22]. Experimental treatments were used, including three organic sources (Peach leaf and rotten fruit on a dry basis, Peach residue compost and Bio char of these residues), three P rates (P1=50, P2=75, and

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P3=100 kg P ha-1) with two beneficial microbes (Phosphate solubilizing bacteria and Trichoderma G8 Strain) using Azam Pre-basic maize cultivar [23]. Data were recorded on the weed density m-2 of the different weed species at the time of pre-and post-emergence of each crop. Relative weed density, frequency, total weed density was recorded and statically analyzed using Fisher 's analysis of the variance technique and the Least Significant Difference (LSD) test at a 5% probability level to compare significant treatment means [24].

RESULTS

Euphorbia heterophylla L. Family *Euphorbiaceae*

Description of the weed: It is an erect, sub-glabrous or sparsely pubescent herb. The leaves are opposite and the leaves are petiolate. Leaf laminate is elliptical-obovate to elliptical-oblanceolate, apex is subacute. The base is round, the leaf blade is variable. The inflorescence is Cyathia, which is present in terminal clusters [25-28]. The fruit is round trilobite, smooth and glabrous. Common weed of a farm up to 1525 m in Swat. Although it contains latex with a caustic effect on the skin and mucous membranes, it is widely used in traditional African medicine as well as in other tropical countries [29,30]. All parts of the plant contain latex: 0.42% leaves, 0.11% stems, 0.06% roots and 0.77% whole plant. The plant also contains lectins and carbohydrates. The red coloring matter of the colored leaves and bracts is porcetin [31,32]. The purgative action of the plant was found to be the joint action of both phorbols and laxative sugars. The water extract from the leaves showed strong purgative effects when given orally. *In-vitro* experiments suggest that the effect is caused by an increase in intestinal motility. The butanol extract of the dried leaves showed a marked inhibitory effect on the growth of *Escherichia coli, Staphylococcus aureus, Pseudomonas aeruginosa, Klebsiella pneumoniae* and *Bacillus subtilis* at 100 mg/ml [33-35]. The aerial extract of methanol showed moderate antiplasmodial activity. The leaf extract showed significant nematicide activity against *Meloidogyne graminicola*. An extract of the aerial parts administered orally to goats showed moderate activity against several intestinal nematodes, such as *Haemonchus, Trichostrongylus, Bunostomum* and *Oesophagostomum* [36,37]. Extracts from the fresh shoots produced inhibitory effects on the early seed germination of tomato, pepper and cow pea. A decoction or infusion of the stems and fresh or dried leaves is taken as a purgative and laxative to treat stomach-ache and constipation, and to expel intestinal worms. A leaf infusion is used as a wash to treat skin problems, including fungal diseases, and abscesses. The leaf extract is taken to treat body pain [38-40]. The latex and preparations of the leaves and root are applied to treat skin tumours. The roots are cathartic, emetic and galactogogue. They are used in small doses in the treatment of gonorrhoea and to increase milk production in breast-feeding women [41-43]. The latex is irritant to the skin and eyes and may be employed as a rubefacient and to remove warts and corns. However, the latex is also used as an antidote against the irritation caused by the latex of other *Euphorbia* species (Figure 1).

Figure 1) *Euphorbia heterophylla*

Phylanthus fraternnus Webster/Family *Phyllanthaceae*

Description of the plant: Monoecious, annual erect annual herb up to 45–60 cm tall, glabrous to short-hairy; vertical shoots angular, pale brown, lateral shoots up to 10 cm long.

Leaves alternate, distichous, almost sessile; stipules c. 1 mm long, linear-lanceolate, whitish; blade elliptical-oblong, 5–13 mm × 2–5 mm, base cuneate to rounded, apex obtuse or rounded, glabrous, with 4–7 pairs of lateral veins[44-46].

Flowers in the axils of leaves, male flowers 1–3 per axil at the base of branches, other leaf axils usually with 1 female flower.

Flowers unisexual; pedicel c. 0.5 mm long; male flowers with 6 perianth lobes, obovate-orbicular, c. 0.5 mm long, in 2 whorls, translucent, disk glands 6, free, flattened, stamens 3, filaments fused; female flowers with 6 perianth lobes c. 1 mm long, the outer ones oblong-lanceolate, the inner ones oblong to oblanceolate, white, disk c. 0.5 mm across, fringed, ovary superior, c. 0.5 mm in diameter, 3-celled, styles 3, c. 0.5 mm long. Fruit a 3-lobed nearly globose capsule c. 1 mm × 1.5 mm, smooth, yellowish, 6-seeded. Seeds c. 1 mm long, segmented, yellowish brown, one side with dark brown tubercles, with concentric ridges on the other side (Figure 2).

Figure 2) *Phylanthus fraternnus Webster*

Occurrence: Common weeds of fields from plains to 1700 m. The leaves are strongly diuretic. A decoction is drunk to facilitate childbirth, and against oedema, costal pain and fever. In Sudan the leaves are given against dysentery. The young leaves are given to children as a treatment for coughs and hiccups. A plant extract is reported to be strongly diuretic and is taken to allay spasms, such as griping in dysentery [47-52]. The plant is also used as a laxative and to treat gonorrhoea, dropsy, diarrhoea and malaria. The plant extract is applied externally to treat skin infections. The plant sap is applied to treat bruises, sores and ulcers, and mixed with oil against ophthalmia and conjunctivitis. The fruits are used in the treatment of ulcers, wounds, sores, scabies, ringworm and other skin problems. Fresh roots are taken against jaundice, and crushed with milk are used as a galactagogue. A decoction of roots and leaves is used to treat malaria. Powdered roots and leaves are made into a poultice with rice-water to treat oedema and ulcers [53-56].

Portulaca oleracea

Portulaca oleracea (common purslane, also known as verdolaga, pigweed, little hogweed, red root, parsley) is an annual succulent in the family *Portulacaceae*, which may reach 40 centimetres (16 in) in height.

Description of the plant: It has smooth, reddish, mostly prostrate stems and alternate leaves clustered at stem joints and ends. The yellow flowers have five regular parts and are up to 6 millimetres (0.24 in) wide. Depending upon rainfall, the flowers appear at any time during the year. The flowers open singly at the center of the leaf cluster for only a few hours on sunny mornings. Seeds are formed in a tiny pod, which opens when the seeds are mature. Purslane has a taproot with fibrous secondary roots and is able to tolerate poor compacted soils and drought [57-60].

Uses: Fruits-raw or cooked. An acid flavor. The fruits are used to make an alcoholic drink of low quality. The small fruits are around 2-3 mm in diameter. A decoction of the root is considered to be stimulant and is drunk to improve endurance during hard physical work or as an aphrodisiac. It is also taken to treat nervous depression, impotence and tiredness after prolonged diarrhea. The crushed roots are applied as a poultice to abscesses and furuncles [61-64]. A decoction of the twig or stem bark is taken to treat colic, amoebic dysentery and persistent diarrhea (Figure 3).

***Parthenium hesterphorus* Family, *Asteraceae*:** The decoction of *P. hysterophorus* has been used in traditional medicine to treat fever, diarrhoea, neurologic disorders, urinary tract infections, dysentery, and malaria and as emmenagogue. Ethno botanically, it is used by some tribes as remedy for inflammation, eczema, skin rashes, herpes, rheumatic pain, cold, heart trouble and gynecological ailments [65]. *Parthenium hysterophorus* has been found to be pharmacologically active as analgesic in muscular rheumatism, therapeutic for neuralgia and as vermifuge. This weed is also reported as promising remedy against hepatic amoebiasis. Parthenin, the major constituent of the plant, exhibits significant medicinal attributes including anticancer property (Figure 4).

Figure 3) *Portulaca oleracea*

Figure 4) *Parthenium hesterphorus*

IPomoea nil* (L.) Roth/Family *Convulvolaceae

Description of the plant: the common morning-glory, tall morning-glory, or purple morning glory. The leaves are heart-shaped and the stems are covered with brown hairs. The flowers are trumpet-shaped, predominantly blue to purple or white, 3–6 cm diameter [66].

Uses: The seed is anthelmintic, anticholinergic, antifungal, antispasmodic, antitumor, diuretic and laxative. It is used in the treatment of oedema, oliguria, ascariasis and constipation. The seed is also used as a contraceptive in Korea. The seed contains small quantities of the hallucinogen LSD (Figure 5).

Figure 5) *IPomoea nil (L.) Roth*

Convolvulus arvensis* /Family: *Convolvulaceae

Description: Creeping vine with sharp-lobed, arrow-shaped leaves. Flowers are white or pink and morning-glory-like in that they are trumpet-shaped [67]. Flowers present June through September (Figure 6).

Figure 6) *Convolvulus arvensis*

Leaves: Tea made from leaves used as a wash on spider bites. Tea ingested to reduce profuse menstruation. Leaves have laxative effects

Flower: Flower tea used to reduce fever and heal wounds. Flowers are also laxatives [68].

Root: Roots have strong emetic effects. Root tea is a laxative.

Erigeron canadensis (synonym ***Conyza canadensis*)/Family *Asteraceae*:** *Erigeron canadensis* (synonym *Conyza canadensis*) is an annual plant native throughout most of North America and Central America. *Erigeron canadensis* is an annual plant growing to 1.5 m (60 inches) tall, with sparsely hairy stems. The leaves are unstalked, slender, 2–10 cm long and up to 1 cm (0.4 inches) across, with a coarsely toothed margin. They grow in an alternate spiral up the stem and the lower ones wither early. The flowers are produced in dense inflorescences 1 cm in diameter. Each individual flower has a ring of white or pale purple ray florets and a centre of yellow disc florets. The fruit is a cypsela tipped with dirty white down (Figure 7).

Figure 7) *Erigeron canadensis*

Echinochloa crusgalli* /**Family ***Poaceae: *Echinochloa crus-galli* is a type of wild grass originating from tropical Asia that was formerly classified as a type of panicum grass. This plant can grow to 60" (1.5 m) in height and has long, flat leaves which are often purplish at the base. Most stems are upright, but some will spread out over the ground. Stems are flattened at the base [69]. The seed heads are a distinctive feature, often purplish, with large millet-like seeds in crowded spikelets (Figure 8).

Figure 8) *Echinochloa crusgalli*

***Asparagus officinalis*/**Family ***Liliaceae*:** Asparagus, or garden asparagus, scientific name *Asparagus officinalis*, is a spring vegetable, a flowering perennial plant species in the genus Asparagus (Figure 9).

Figure 9) *Asparagus officinalis*

DISCUSSION

Constituents

1. Root yields asparagin, a greenish yellow resin, sugar, gum, albumen, chlorides, acetate and phosphate of potash, malates, etc.

2. Fruit contains grape-sugar and sparagancin, a coloring matter.

3. Seeds yield a fixed oil, aromatic resin, sugar, and a bitter principle–spargin.

4. Amino acids and inorganic mineral contents were found much higher in the leaves than the shoots.

Properties

1. Asparagin imparts the characteristic strong urine smell, and believed to stimulate the kidneys.

2. Considered mild aperient, diuretic, sedative, laxative.

3. Green resin is believed to be calming to the heart.

4. Studies suggest numerous medicinal properties: antispasmodic, anti-inflammatory, diuretic, Diaphoretic, demulcent, immunomodulation, laxative, and sedative.

5. Fruit is considered poisonous to humans.

Edibility/Nutritional

A much desired vegetable, especially the tips Contains many vitamins and minerals: Vit A, B1-6-12, C, E, K, calcium, magnesium, zinc, dietary fiber, rutin, niacin, folic acid, iron, selenium, among others.

Folkloric

1. Green resin used for flatulence, calculous affections, cardiac dropsy, rheumatism, and chronic gout.

2. Given in doses of 1 to 2 grains, combined with potassium bromide, for cardiac dropsy and chronic gout.

3. Water, in which asparagus was boiled, although disagreeable, is good for rheumatism.

4. In Brazil, roots considered a powerful diuretic.

5. Roots also used for bronchial catarrh and pulmonary tuberculosis.

6. In Tehran, roots are burned and smoked to relieve toothaches.

7. Rhizome is used as cardiac sedative, palliative, diuretic, and laxative.

***Cynodon dictylon* (Family Poaceae):** *Cynodon* has a renowned position in medicine and many parts of the plants are assumed to have medicinal properties. A traditional use of *Cynodon* is for eye disorders and weak vision; the afflicted are advised to walk bare foot on dew drops spread over *Cynodon* plant each morning. *Cynodon* plant is pungent, bitter, fragrant, heating, appetizer, vulnerary, anthelmintic, antipyretic, alexiteric. It destroys foulness of breath, useful in leucoderma, bronchitis, piles, asthma, tumors, and enlargement of the spleen [70]. According to Unani system of medicine, *Cynodon* plant is bitter, sharp hot taste, good odor, laxative, brain and heart tonic, aphrodisiac, alexipharmic, emetic, emmenagogue, expectorant, carminative and useful against grippe in children, and for pains, inflammations, and toothache. Virus-affected discolored leaves of *Cynodon* are used for the treatment of liver complaints. In Homoeopathic systems of medicine, it is used to treat all types of bleeding and skin troubles (Figure 10).

***Digera muricat* Amaranthaceae:** *Digera muricata* is an annual herb growing up to 70 cm tall with a stem that can be simple or branched. Often gathered from the wild for local use as a food, in some areas it is also cultivated and sold in local markets. Leaves and young shoots–cooked. Used as a pot herb. The plant is often used locally as a vegetable, and is particularly popular as a cooked vegetable. Used internally against digestive system disorders. The seeds and flowers are used to treat urinary disorders (Figure 11).

Figure 10) *Cynodon dictylon*

Figure 11) *Digera muricata*

Solanum nigrum

Plant description: It is a perennial herb, upto 30-60 cm tall, erect, branched. Leaves are ovate and lanceolate in shape. 2-3 cm in width and 3 to 5 cm in length. Flowers are small, white in colour, arrange in cymose manner, fruit is a berry that is about 6 mm in diameters. Yellow or green when unripr and turns red then black on ripping. Flowering Period lasts almost throughout the year.

Uses: Green berries are mashed and locally rub or massaged on the ring worm infected area to treat it. Leaves are boiled and the decoction id used as to reduce fever. A decoction of the berries and flowers is effective in relief to cough and cold. Berries are smashed and applied as poultice to cure rheumatic joints and as emollient for erupted skin (Figure 12).

Figure 12) *Solanum nigrum*

CONCLUSION

Major weeds of maize crop, *Euphorbia heterophylla L, Phylanthus fraternnus L. (Webster), Portulaca oleracea L., Parthenium hesterphorus L., IPomoea nil L., Erigeron canadensis L., Echinochloa crusgalli L., Asparagus officinalis L., Cynodon dictylon L., Digera muricata L., Cyprus reotendous L. and Solanum nigrum* L. were recorded and concluded that mostly up to 70% yield reduction in maize crop caused by weeds competition. The most abundant and flourished weeds were observed *Cyprus reotendous* L, and *Cynodon* dictylon and badly effected crop yield. Therefore economically sound and environmental friendly weeds control measure should be adopted to eradicate weeds and overcome on hunger and food security.

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