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ORIGINAL ARTICLE

Weed species composition and distribution pattern in the maize crop under the influence of edaphic factors and farming practices: A case study from Mardan, Pakistan

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Indicator species

Abstract Weeds are unwanted plant species growing in ordinary environment. In nature there are a total of 8000 weed species out of which 250 are important for agriculture world. The present study was carried out on weed species composition and distribution pattern with special reference to edaphic factor and farming practices in maize crop of District Mardan during the months of August and September, 2014. Quadrates methods were used to assess weed species distribution in relation to edaphic factor and farming practices. Phytosociological attributes such as frequency, relative frequency, density, relative density and Importance Values were measured by placing 9 quadrates (1×1 m^2) randomly in each field. Initial results showed that the study area has 29 diverse weed species belonging to 27 genera and 15 families distributed in 585 quadrats. Presence and absence data sheet of 29 weed species and 65 fields were analyzed through PC-ORD version 5. Cluster and Two Way Cluster Analyses initiated four different weed communities with significant indicator species and with respect to underlying environmental variables using data attribute plots. Canonical Correspondence Analyses (CCA) of CANOCO software version 4.5 was used to assess the environmental gradients of weed species. It is concluded that among all the edaphic factors the strongest variables were higher concentration of potassium, organic matter and sandy nature of soil. CCA

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plots of both weed species and sampled fields based on questionnaire data concluded the farming practices such as application of fertilizers, irrigation and chemical spray were the main factors in determination of weed communities.

1. Introduction

Weeds are the part of dynamic ecosystems, start off in ordinary environment and become obstacle to the crops (Baker, 1974). Weeds are unwanted plant species emergent in the cultivated crops and grow where they are not needed. Out of 8000 only 250 weed species are important for agriculture world (Holm et al., 1979). Weeds cause great destruction to crops as they increase the costs of different cultural practices, decrease the effectiveness of agricultural equipment and excellence of fertile lands, decrease the germination capability of crops seed due to the phytotoxins or allelochemicals (Algandaby and Salama, 2016). Weeds have some pinpointing characters, such as short seed dormancy, high seed germination rate, environmental plasticity, fast seedling growth and reproductive capability, short span of life cycle, self-compatibility, efficient and well organized methods of seed desperation, manufacturing of diverse types of allelochemicals and tolerance to abiotic and biotic stresses (Baker, 1974; El-Sheikh, 2013). It allows the weed species to survive and grow in different ecological habitats. Due to this weeds are becoming dominant all over the world (Holm et al., 1979, 1997) and damage the local biodiversity (Duke, 1983; Tilman, 2000).

Zea mays is cross pollinated, annual, short day plant of the earth. In Pakistan maize is progressively gaining more significant position in crop husbandry due to its higher yield potential and short development period (Khan et al., 2011a,b; Olsen et al., 2006). The maize crop faces lots of difficulty because the farmers typically give more importance to a small number of cultural practices and ignore other factors resembling as weed control and seed rate. In Pakistan during 2012–13 maize yields 36.581 m ton production in a total of 0.981 m ha cultivated area and in the same year in KPK maize yields 1.468 m ton product in 0.512 m ha cultivation area. A number of weed species that are the tough competitors, compete for existing resources with the maize crop (Al-Shahwan et al., 2016; Gomaa, 2012; Malik et al., 2006). This competition is most grim and significantly decreases maize product at early crop growing period (Mitchell and Tu, 2005).

The present study analyzed the ecological relationship among the distribution of weed communities and their environmental factor in Shahbaz Ghari, District Mardan, Pakistan. It also reveals the weed species types and its distribution pattern, composition and abundance along with the edaphic factor and farming practices that determine the distribution of the weed species and communities in the study area.

2. Materials and methods

Shahbaz Ghari is a Union Council of District Mardan, Khyber Pakhtunkhwa located on mardan sawabi road having an area of 3956 hac. The people of an area mostly depend on agriculture. Important crop of the area includes Maize and wheat. For the first time the present study was carried out to find out the relationship among weed species, edaphic factors and farming practices in maize crop of Shahbaz Ghari District Mardan during the month of August and September 2014. Different stations were recognized at random intervals on both sides of the road at different distance using quantitative ecological techniques. Quadrat having 1×1 m^2 size and square shape were placed systematically in the projected area (Shahbaz Garhi) and data collected from different stations (Clements, 1905; Khan et al., 2011a,b, 2012). In each field nine quadrats were positioned and density, frequency, relative density, relative frequency and Importance Values were measured respectively (Curtis and McIntosh, 1950). Associated data i.e., soil data for testing and different methods were based to ask various questions from farmers to collect information concerning farming practices. Weed plant specimens were collected, labeled with tags and pressed in plant presser. After drying the plant specimen were poisoned and mounted on standard herbarium sheets. Specimens were identified using available literature (Ali and Qaiser, 1995; Khan et al., 2014, 2013a,b). The specimens were deposited in the Herbarium of Hazara University Mansehra Pakistan.

2.1. Soil collection

A total of sixty-five soil samples were collected up to one feet depth from different fields. These soil samples were placed in plastic bags, brought to laboratory; air dried and ground to form one composite sample. The analysis concerned with the physiochemical properties of these soil samples was carried out in the agriculture research laboratory Mansehra. During soil analysis the soil pH, electrical conductivity (E.C.), organic matter, calcium carbonate concentration, soil texture, phosphorus and potassium parameters were measured. Soil pH and electrical conductivity were measured using 1:5 soil water suspension by pH meter and conductivity meter respectively (Rhoades et al., 1990). Soil texture was determined by the walky-black procedure and texture class was determined with the help of a textural triangle (Adamu and Aliyu, 2012). Organic Matter was determined by the hydrometer method. (Koehler et al., 1984; Nelson et al., 1996).

2.2. Data analyses

The data of 585 quadrats were put in MS EXCEL to prepare presence and absence data sheet for Cluster and Two Way Cluster Analysis. The weed data, soil and questionnaire data were analyzed through PC-ORD version 5 to find out the effect of edaphic factor and farming practices on weed species distribution and composition pattern. Through CANOCO software version 4.5 data attribute plots were derived to find out the effect of multivariate environmental, edaphic factor and farming practices on weed species plus the position of indicator species in each region (Khan et al., 2012, 2013b).