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Review Article

A review: *Cuscuta (Cuscuta planiflora)* major weed threat in Punjab-Pakistan

Mazher Fareed Iqbal¹, Muzammil Hussain¹, Abdul Hayee Abid², Muhammad Anjum Ali³, Rab Nawaz⁴, Masood Qadir Waqar⁵, Muhammad Asghar¹ and Zeeshan Iqbal⁶

¹ Adaptive Research Farm, Gujranwala

² Pest Warning & QCP Ali-Pur

³ Director General Agriculture (Ext. & A. R) Lahore-Punjab

⁴ District Officer, Hafizabad

⁵ Director Agriculture (A. R) Lahore-Punjab

⁶ University of Sargodha-Sargodha

*Corresponding author e-mail: mazherfareed2004@gmail.com

Abstract

The survey was conducted to evaluate the *Cuscuta* weed; its distribution in fellow lands causing major threat to Punjab Pakistan. The crops which are susceptible to attack (alfalfa, safflower, melons, onions, carrots, berseem, ber tree and sugar beets etc). Most broadleaf weeds also served as hosts to *Cuscuta*. *Cuscuta* seed germinates from late-February through mid-May. *Cuscuta* is rootless plant; it requires attaching to a suitable host plant within two to three days of emergence from the soil, in the absence of host it will die. It takes nutrients from soil at germination & afterward attached to a suitable host for its survival. As a parasitic weed in berseem fodder, it attaches to the plant stem; penetrated the epidermis and entered into the vascular tissue to gain water and nutrients for its survival. As it continued to feed on the host plant, its growth expands rapidly, persistent the original host and surrounding plants with its thin yellow strands. The growth of attacked plant will be retarded. However control measures for small-seeded *Cuscuta* are limited or the control treatments usually damaging the host plant. So only physical control is more effective which is not feasible on larger scale.

Keywords: *Cuscuta* weed; damage; distribution; seed dispersal; Control.

Introduction

Cuscuta (Cuscuta planiflora) well known as Akas bail or dodder has hard-coated seed that can remain dormant in the soil for more than 20 years. It is an annual parasitic weed that infested thousands of acres of horticultural plants and agriculture crops in Pakistan. It is stem holoparasitic belonging to the family Cuscutaceae. It grows only by penetrating tissues of host plants to obtain water and nutrients. It is not known how long small-seeded *Cuscuta* has been present in Pakistan. Infestations have subsequently been found in a wide range of soil and

vegetation types (Western Australian Herbarium 1998). Small-seeded dodder was discovered parasitizing canola crops for the first time, in the Geraldton area of Western Australia in 2001 and later in a lupin crop in the Nanson area. The result was stunted crop growth tremendously. However numerous studies of dodder species have been revealed that heavily infestation was found in different crops (Dawson *et al.*, 1994). *Cuscuta* has become a serious weed and threat to agriculture in Pakistan which flourished in favorable climatic

conditions; presence of host; availability of pollination and dispersal vectors such as predators. Infestation by *Cuscuta* resulted in huge yield loss due to reduced flower/fruit size and seed production ultimately death of host plant. In addition increased in cost of production due to control or seed cleaning costs, and reduced crop marketability. Therefore, it is essential that management options should be implemented to sustain yields and help to reduce future attacks. However there are no magic bullets to control *Cuscuta* in horticultural plants and agricultural crops.

Description

Cuscuta weed has yellowish, twining stems up to 0.3 mm wide; with leaves absent or reduced to minute scales. Sub sessile, 4-5 flowers form in a compact up to 3 mm long whitish and somewhat fleshy inflorescence. The calyx is broadly campanulate with acute fleshy or turgid lobes and almost encloses the corolla tube. Within the corolla tube, the stamens are subtended by scales, which almost reach the stamens or are shorter. Scales are fringed, usually oblong and bridged low down or at the middle. Stamens are shorter than the corolla lobes with filaments that may or may not be equal in length to the anthers. The two styles may be longer or shorter than the stigmas, and are slender above globes, two-celled ovary. The capsule is depressed globose; splitting around the base. The four ovoid, granulate seeds are mostly shorter than 1 mm (Dawson *et al.*, 1994).

Life History

Cuscuta weed is annual plants that reproduce through seed. Unlike other parasitic plants, its seedlings germinated throughout the year, without stimulation by a host species, providing that there is sufficient soil moisture for germination and 3-6 cm of growth. Seedlings germinated on or near the soil surface and did not produce roots producing single stem that developed upward without leaves and twines around any nearby vertical object. If no suitable host is encountered within several days, the seedling will die. The seedling entwines about the host stem and produces haustoria that penetrated the

surface through enzymatic action. This enabled the parasite to draw water and nutrients from the host (Dawson *et al.*, 1994). The stems continued to develop, branching and twining through the host plant; developing more haustorial attachments and spreading to adjacent plants. Flowering of *Cuscuta* weed occurred in summer from January-May (Meeuse and Welman 2000). Seed set occurs within a month of flowering (Salle *et al.*, 1997). Hard coated seed is broken down over time through natural processes. Its seed remained viable in the soil up to 20 years, with germination of seedlings occurring periodically under favorable environmental conditions. Scarification of seed coat at the time of sowing of the host trigger a flush of Akas germination. Akas died off annually with senescence of the host or in response to frost (Dawson *et al.*, 1994). The germination trials of *Cuscuta* weed determined that the optimum temperature for germination is 30°C (Zaki *et al.*, 1998) conducted. Neutral or slightly alkaline media were determined to be the most suitable for the germination of *Cuscuta* seeds.

Distribution

Small-seeded *Cuscuta* weed is a native of the Asia, Africa, Mediterranean region which has become naturalized in more than forty countries including Pakistan (Anonymous, 2000).

Dispersal

Seeds of *Cuscuta* weed usually dispersed close by the parent plant. Wind has little effect on the dispersal of Akas seed due to the seed weight and shape (Dawson *et al.*, 1994). Seed may be passed through birds or mammals stomach their movement and deposition of faeces (Lee and Timmons 1980; Anonymous, 2000). Seed was distributed in mud or manure adhering to fur, feathers or feet of animals (Cooke, 2001). Dispersal of its seed is known to be primarily through contaminated crop seed (Parker, 1991). The seeds are small; easily confused with those of clover and cleaning of lucerne, berseem seed become difficult and expensive. Other recorded methods of spread of *Cuscuta* species included fodder movement, soil movement on

livestock or machinery and seed spread through irrigation water or run-off. Seed potentially spreaded through stock and through mechanical spreading of contaminated manure (Lee and Timmons 1980).

Symptoms of Infestation

Cuscuta weed species draw water and nutrients from their host, leading to reduce growth and development of the host plant resulting the death of the host. Presence of strands of Cuscuta on the plant is the primary symptom of infestation. In some hosts, yellowing or reduced flowering/fruit set may be observed however these symptoms have not been documented. From a distance, large infestations of Cuscuta appeared as a whitish (flowering) or yellow area in a crop, due to the presence and color of the parasite on the crop (Anonymous, 2000).

Host Range

The worldwide host range of small seeded Cuscuta is expected to be wide ranging, due to its adaptability occurrences included its presence on citrus, grapes, ber tree many legumes (beans; clover i.e. Lucerne; Berseem etc); solanaceous vegetables (eggplant; tomato; capsicum etc); onion and other monocots; cucumber; chrysanthemum and sugar beet. Non-crop hosts included *Solanum* spp., *Rumex* spp. and *Senecio vulgaris* (Orloff *et al.*, 1989, Sher and Shad 1989, Parker and Riches 1993 Zaki *et al.*, 1998, Meeuse and Welman 2000, Cooke, 2001). Parasitization of monocots by Akas bail is uncommon, with grasses usually being immune, but there are records of attachment to asparagus and onion by some species (Dawson *et al.*, 1994). Cuscuta weed has been found parasitizing Berseem, ber tree, canola and some native species in Pakistan but its potential host range is significantly greater.

Environmental Impact

Cuscuta species have wide range of host and are known to occupy native vegetation. This may significantly impact on biodiversity in infested areas. However the control of Akas bail commonly

involved host death and is not practical for control of large infestations in native vegetation. Cuscuta weed infestations created hindrance to wildlife movement through their ability to close off areas of bush with dense net like vegetation masses. Small animals may become entangled in it leading to their death from thirst or starvation. There is no known health problems associated with dodder however it presents a minor tripping hazard (Dawson *et al.*, 1994).

Cultural Control

In long term management of Cuscuta control and prevention of seed set are the most important aspects of managing infestations. Seed set prevention is critical because removal of the long-lived seed from the soil may take twenty years or more. The soil seed bank can be reduced through rotation with a non-host monocot crop for a long time period, providing that strict control of broad-leaved weeds in the crop is carried out to prevent the host (Dawson *et al.*, 1994). Burning of crops to destroy fruiting dodder is a useful mechanism for the control of seed production (Cudney *et al.*, 1992). It also kills seeds present on the soil surface. In orchards, pruning of infested branches is the most effective method to control cuscuta attack. In sowing crops, repeated tilling is a useful method of destroying germinating dodder seedlings between rows. Cool temperatures retard dodder growth, so careful timing of crop sowing can reduce levels of infestation (Dawson *et al.*, 1994). A reduction in dodder seedling emergence of some 99% has been achieved in large-seeded dodder through burning of the crop and parasite (Cudney *et al.*, 1992). Control seed to prevent further spread is a primary consideration. Practice good early-season weed control with timely post-emergence herbicide sprays, close cultivation, and hand weeding are good practices for better control. Rotating to non-host crops like cotton, cereals, or corn will reduce populations of dodder since they do not attach and produce additional seed. Remember, rotating to crops like melons, safflower, melons, onions, or sugar beets only encourage dodder survival. While there is no one sure-fire method of controlling dodder in tomatoes, there are several options

available that can help to reduce the impact on tomato production and future seed production. Dodder seed will survive in the soil for many years, so planning for the long-term is the only way of managing dodder effectively.

Chemical Control

Control of *Cuscuta* species using herbicides is frequently ineffective and often results in host death. One of the most successful strategies (Cudney *et al.*, 1992) who suggest control of large-seeded dodder in lucerne with trifluralin, a method that is largely applicable to canola and pulses as well as having relevance for other crops. Trifluralin granules applied pre-emergence result in a high % kill of the dodder but are only effective for a few weeks. Dodder plants that survive trifluralin application will grow enough during the season to reduce the yield to levels that are similar to those experienced with no control (Orloff *et al.*, 1989). Herbicides are more effective if translocated from the host plant to the dodder rather than applied directly to the dodder foliage. Translocated herbicides kill the haustoria, which the dodder might otherwise regenerate (Dawson *et al.*, 1994). In lucerne, low levels of glyphosate (75–150g/ha) will act as a selective control (Dawson, 1990). Partially selective control of dodder species in other crops with low-level glyphosate application has been seen (Abu-Irmaileh and Saghir, 1994). There is a wide range of other herbicides known to control dodder species in a variety of crops, with varying levels of effectiveness. Fumigation of the soil to destroy seed in the soil is an expensive option that should be considered to eradicate.

Conclusion

Seeds of crops free of *Cuscuta* seeds should be used. In crop it should be removed manually by pulling it because this technique is most profitable and economical. Herbicides are not be effective measure for controlling *Cuscuta* so every one should avoid it.

References

Abu-Irmaileh, B.E. and Saghir, A.R. 1994. Components of successful weed management with

special reference to vegetable growers in the Near East. *FAO Plant Protection-Bulletin*, 42, (4):191-200.

Anonymous, 2000. *Dodder Weed Identification Note* (Animal and Plant Control Commission of South Australia, South Australia).

Cooke, D. 2001. Personal communication with David Cooke, Senior Botanist with PIRSA. (Department of Primary Industries and Resources, South Australia).

Cudney, D.W., Orloff, S.B. and Reints, J.S. 1992. An integrated weed management procedure for the control of dodder (*Cuscuta indecora*) in alfalfa (*Medicago sativa*). *Weed Technology* 6: 603-606.

Dawson, J.H. 1990. Newly seeded alfalfa (*Medicago sativa*) tolerates glyphosate and SC-0224 at doses that control dodder (*Cuscuta* spp.). *Weed Technology* 4: 876-879.

Dawson, J.H., Musselman, L.J., Wolswinkel, P. and Dörr, I. 1994. Biology and control of *Cuscuta*. *Reviews of Weed Science* 6: 265-317.

Lee, W.O. and Timmons, F.L. 1980. *Dodder and its control*. Farmers Bulletin No. 2117 (United States Department of Agriculture, Washington).

Meeuse, A.D.J. and Welman, W.G. 2000. *Flora of South Africa Volume 28, Part 1: Convolvulaceae* (National Botanical Institute, Pretoria).

Orloff, S.B., Vargas, R.N., Cudney, D.W., Canevari, W.M. and Schmierer, J. 1989. Dodder control in alfalfa. *California Agriculture*. 43: (4), 30-32.

Parker, C. 1991. Protection of crops against parasitic weeds. *Crop Protection* 10: 6-22.

Parker, C. and Riches, C.R. 1993. *Parasitic weeds of the world biology and control*. (CAB International, Wallingford, UK).

Randall, R. 2001. *Climate map of Cuscuta planiflora potential distribution in Western Australia*. (Unpublished Data, Department of Agriculture, Western Australia).

Sallé, G., Tuquet, C. and Raynal-Roques, A. 1997. *Biologie des phanerogames parasites*. *Comptes Rendus des Seances de la Societe de Biologie et de ses Filiales* 192, 9-36.

Sher, M.A. and Shad, R.A. 1989. Distribution, hosts and measures to control dodder. *Progressive Farming* (9): 6,17-20.

Western Australian Herbarium 1998. Flora Base – Information on the Western Australian flora. Department of Conservation and Land Management. URL: <http://www.calm.wa.gov.au/science/florabase.html> (accessed 24th January 2002).

Zaki, M.A., El-Metwaly, H.S. and Hassan, R.A. 1998. Studies on dodder (*Cuscuta* spp.) control. Proceedings of the 6th Mediterranean Symposium EWRS, pp 147-151.