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Coriander Stem Gall And Its Management: An Overview

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Abstract: Coriander is an important seed spice crop of this region grown for leaf as well as seed purpose. Cultivation of this crop suffers from major yield losses by stem gall disease. The disease symptoms appear in the form of small protuberance of stem and as hypertrophied seeds. Management of disease is important in view of its severity, yield losses and quality of seeds. The objective of present article is providing an overview about different germplasm screened, management strategies used with chemicals fungicide and bio-agents by many researchers for stem gall disease of coriander.

1. INTRODUCTION

India is known as the home of spices having preeminent situation as consumer, producer and exporter in the world. Seed spices have risen as one of the significant groups of spice crop in India. Major growing areas lie in arid to semi-arid region. The global demand assessed for seed spices crop is 150000 tones, of which India contributes 70,125 tons annually representing for 47 per cent of the total world trade (Malhotra and Vashishta, 2008). The seed spices account for about 36 and 17 per cent of the total area and production of spices in the country respectively, and now an expending trend in export of seed spices has been recorded in the last decade particularly to Asian, Latin American and middle eastern developing countries. Coriander is one of the them. India export a large quantity of coriander to other countries, that touched around 302.00 mt of coriander seeds and value-added products valued at 204 crores in 2008 (Spices Board, 2009) from an area of 396.85 ha with productivity of 11.21 m/ha. During the year 2008-09, the area under cultivation of coriander in U.P. was 61.32 ha with an average production of 3563 mt and productivity of 0.598 mt/ha. In Faizabad district the area is around 8.99 ha with an average production of 522 mt. Coriander (*Coriandrum sativum* L.) is a member of family Apiaceae belonging to herbaceous plant and grown as seed spices in most of the states of India. In India, coriander is largely cultivated in states of Rajasthan (54%), Madhya Pradesh (17%) contributing about 2/3 of countries total production. Other states include Andhra Pradesh, Gujrat, Assam, Karnataka, Punjab, Orissa, Tamil Nadu, Uttar Pradesh and Uttarakhand. Rajasthan is major coriander growing and producing state with its share of about 60% in the total area and production of the country. The demand is gradually increasing because of its medicinal value of seeds that is gaining importance in view of their inbuilt extractable constituents and their convenient use (Rama Murthy and Sridhar, 2001; Thakral et al., 2002 and Jakhar and Rajput, 2005). Two types of seed i.e. large seeded (3-5 mm diameter) and small seeded types (1.5 to 3 mm) have been reported to belong the vulgare and micro-sporum group, respectively. Large seeded types contain 0.1-0.35% oil content whereas, small seeded type possess more than 0.4% oil contents. In India, large seeded types are being replaced by small seeded as having more oil contents and export quality value. There is a scope for export of quality seed spices and

value-added products to other countries. The cultivation of this most important seed spice crop suffers from major problem of high incidence of disease like stem gall (*Protomyces macrospores* Unger), powdery mildew (*Erysiphe polygoni*), wilt (*Fusarium oxyporum*), stem rot (*Rhizoctonia solani*) and other minor diseases (Chattopadhaya and Maiti, 1990; Singh et al., 1996; Keshwal and Khattri, 1998). The losses caused by insect/pests also bear importance as compared to fungal disease. Among all the fungal diseases the stem gall disease is now considered as major disease not only in Eastern U.P. zone but also in most of coriander growing areas causing yield losses up to 15-70% (Pandey and Dangey, 1998). Studies undertaken during the last few years on stem gall disease shows that disease appear regularly every year in the fields of coriander causing heavy losses in Eastern U.P (Chattopadhayay and Maiti, 1990; Saxena et al., 2002). Since the disease cause severe damages at all the stages of growth and therefore, needs immediate attention on the management to reduce losses/ crop damage.

Symptomology

The stem gall disease appears as tumor like outgrowth on stem extending to leaves (thick and leathery) to inflorescence and seeds. The seeds are hypertrophied or hyperplased depending upon stage of infection. Infected seeds are larger than normal seeds. Infected seed posses high concentration of amino acid, reducing sugar and low concentration of non-reducing and total sugar there by reducing the quality of seeds produced (Pavgi and Muthopadhyay, 1972; Goel et al., 1983) and as a result loose their value for use as a seed and for consumption. Disease found as swellings on leaf stalks, leaf veins, stems, peduncles and also on fruits. The vein swellings give a hanging appearance to leaves. At early stage tumors appear glossy but in later stage become rupture and rough. The swellings are mostly elongated, and their size varies according to the size of the infected part, those on the stem being usually larger than those on the flower stalk. Systemic infection provides greater distortion to the plant and plant parts. The inflorescence may show outgrowth on the surface, and uniform invasion of the fruit makes it abnormally large, but partial invasion may lead to distortion (Gupta, 1962)

Epidemiology

Environmental condition plays important role in the development of every plant disease. Coriander stem gall disease also affected by climatic condition such as high soil pH, moisture and appears regularly every year in the field. To determine the severity of epidemics weather conditions, contribute significantly, however, information on this aspect of stem gall disease is limited. In development of stem gall minimum or maximum atmospheric temperature with relative humidity play an important role (Saxena et al., 2002). Sowing time also affect the incidence and severity of disease. Appearance of disease observed on plants when the minimum and maximum temperatures were 13.2 and 30.9^{o}C, respectively and relative humidity was 57.2 percent. Maximum disease intensity was recorded in the plants sown when the minimum and maximum temperature was 8.1 and 22.6^{o}C, respectively, and relative humidity of 65.8 percent. Maximum germination of *P. macrosporus* chlamydospores was observed at 22–24^{o}C (Tripathi et al., 2003). Experimental results showed that, the disease appeared when minimum temperature was 7 and maximum temperature was 26.0°C. The disease increased when minimum and maximum temperature increased from 11 to 13^{o}C and 30 to 32.5°C respectively and above this temperature (36.5^{o}C) the increase in disease intensity was checked (Kumar et al., 2014). In winter season presence of excess soil moisture, low sunshine hours due to cloudy weather enhance the spread of stem gall and can affect the crop up to 100 percent (Malhotra et al., 2016). Development of stem gall disease. That is also observed very high and low soil moisture not suitable for disease development (Leharwan et al., 2018).

Disease management

Coriander 18 verities tested for resistance against *Protomyces macrosporus* Unger in terms of disease intensity and losses in seed yield. Out of 18 varieties tested 9 varieties namely Shujalpur local, NP-92, NOP-95, Delhi-local, and P-107 were found moderately resistant and other shared varying degree of susceptibility (Gupta, 1973). Evaluation and screening of number of germplasms at different location have been undertaken by different workers. 18 coriander varieties were screened against stem gall disease and G-C-88-8, G-5365-91, Pant-1 and UD 20 were found to be moderately resistant under Gwalior condition. Variety CS-4 was found highly susceptible to *Protomyces macrosporus Unger* (Tripathi et al., 1998). Sixteen coriander genotypes were evaluated for 2 years during 1994-96 to judge the oil yield ability of genotypes in the subtropical region of north India. C-1 showed the highest oil yield, seed yield as well as high resistance against stem gall disease (Kalra, 1999). Coriander cultivars were screened for yield potential and resistance to stem gall in an infected plot in Madhya Pradesh during *Rabi* seasons of 1999-2000 and 2000-01. None of the cultivars were completely free from disease but 5 cultivars (like UD-20, G 5365-91, Pant-1, JD-1 and RCr-41 had less than 10% disease intensity (Tripathi, 2001). A greenhouse study was conducted to test some recently developed and popular coriander cultivars to stem gall disease and to estimate the seed yield loss. A significant and positive correlation coefficient was recorded between stem gall intensity and % seed yield loss which indicated that the loss in seed yield increased with the corresponding increase in stem gall intensity. The susceptible cultivar CS-4 had the maximum disease intensity of 4 % in a range of 26-50% (Tripathi et al., 2002). The entries G 5365-91, JD-1, Pant-1, UD-20 and RCr-41 had an disease incidence of 2.0, 4.0, 7.0, 5.0 and 9.0% respectively and were found resistant. The susceptible cultivars CS-4 had the maximum disease intensity of 41.0%. The minimum loss was recorded in JD-1 followed by G-5365-91 (Tripathi, 2002). 40 germplasm were evaluated during 2001-02 for their tolerance to stem gall disease. Minimum seed infection of 1.1 % was recorded in NDCor-1 and NDCor-37 with mean seed yield of 7.05 and 16.86 q /ha respectively (Saxena *et al*., 2002). Seventy accessions of coriander were evaluated for resistance against stem gall. The accession PH- 7, Pant Haritima, COR-17 and COR-2 were highly resistant and has been suggested to use the parents in breeding programme for resistance to against stem gall disease (Singh et al., 2003). Out of 120 Indian accession screened in Lucknow under late planting condition, only one accession CIMAP 2053 was showed tolerance to stem gall disease (Kalra et al., 2003). A number of genotypes have been screened for their tolerance to stem gall disease under the field condition at different centers of All India Coordinated project in Spices crops indicated that UD-475,UD-20,130,278 were free from stem gall disease at Jobner. However, at farmers field none of the entry was found free from the disease. At Danta District Sikar, out of 20 entries tested, UD-118, UD-478 were found free from stem gall disease at farmers field (Anonymous, 2005-06; 2006-07). Genotype RCr-41 and ACR-69 were found free from stem gall and wilt disease incidence (Datta and Choudhauri, 2006).

Biological control agents are successfully used by several workers in their experiment such as *Trichoderma viride* and *Pseudomonas fluorescens* as a seed treatment, soil treatment and as foliar sprays. Seed treatment with *T. viride* 4 g/kg seed + soil treatment by *T. viride* 2 kg/ha was found better for the management of stem gall disease in coriander (Dabbas et al., 2009). Similarly, seed treatment of bio-fungicides like *T. viride* and *Pseudomonas* at the rate of (0.4%) and foliar spray of *Trichoderma* spp. and *Pseudomonas* spp. at the rate of (0.4%) after 40,60 and 75 days of sowing decreased the percentage incidence of disease by 24.50 and 32.65, respectively (Kumar et al., 2014).

Studies have also shown that Captafol at the rate of 2 g/kg was effective in inhibiting chlamydospore germination and improving seedling vigour with partial control of disease in field. Seed treatment with Thiram @ 2 g/kg followed by three spray of Calixin @ 0.1% at

different growth stages of crop have best result for control of disease. Soil and seed treatment with Thiram gave better result (Nene et al., 1966). Seed treatment with Bavistin (Carbendazim), Captan, Thiram and Vitavax (Carboxin) at 2 and 4g a.i./kg seed and foliar spray with Carbendazim (0.2%), Carboxin (0.1%) Copper oxychloride (0.3%), Mancozeb (0.25%), Streptomycin (500 ppm) and Tridemorph (0.1%) were applied at 30, 45, 60 and 75 days after sowing. The better disease control (66.6%) were observed as seed treatment with Captan @ 4 g/kg seed, and as foliar spray 62.5 and 58.3% control was obtained with Streptomycin, Carboxin and Tridemorph, respectively, 30 days after sowing (Lakra, 2000). Four foliar sprays with Captafol or Carboxin and Thiram applied at fortnightly intervals from the time of disease expression were observed more effective than seed treatment or combined seed or soil treatment and in increasing yield of coriander at Rampur, Nepal (Bhardwaj and Shrestha, 1985). The application of some fungicide like Thiram, Captan, Bavistin (Carbendazim), Vitavax (Carboxin) and Mancozeb as seed dressing or seed dressing + foliar spray in disease control examined in a field experiment in Madhya Pradesh during the Rabi seasons of 1997-98 showed lower disease intensity and higher seed yield, seed dressing with fungicide gave better results compared to seed dressing + foliar spray treatment. Thiram, applied as seed dressing or seed dressing + foliar spray, resulted in the lowest disease intensity and higher seed yield (Tripathi et al., 2002). Seed treatment with Agrosan GN at the rate of 2 g/kg, Thiram Bavistin (1:1 proportion) at the rate of 2 g/kg of seed and foliar spray of 0.1% Bavistin (500-700 litre of water) at the time of disease appearance, twice or thrice after 20 days interval were effective in controlling the disease (Singh et al., 2001).

2. CONCLUSION

Stem gall disease is a very serious disease in coriander. It causes damage to foliage as well as seed of coriander, which finally affect severe yield loss. There are many fungicides and biocontrol agent in use but incidence of stem gall is still encountered. Therefore, in view of importance, high incidence/severity of disease and yield losses caused by this disease, proper investigations should be planned.

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