



Investigation of stem gall disease prevalence in coriander in Humid South-Eastern plain Zone-V of Rajasthan

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Summary

Production of coriander is affected by many biotic and abiotic factors. Among them, diseases have been identified as significant limiting factors caused by fungi, bacteria, and viruses. Stem gall caused by the fungus *Protomyces macrosporus* Unger is the most prevalent and damaging disease of coriander. The field survey of stem gall disease of coriander (*Coriandrum sativum* L.) caused by *Protomyces macrosporus* Unger in Humid South Eastern Plain Zone-V of Rajasthan was conducted at five locations in each district viz., Kota, Baran and Jhalawar district for recording incidence and intensity of disease during Rabi 2021-22. The maximum stem gall disease incidence was recorded in Ramganj Mandi (70%) of Kota district, followed by incidence in Kalya Khedi (60%) of Kota and incidence in Shahbad (60%) of Baran district. In contrast, minimum stem gall disease of coriander incidence was observed in Kanwas (25%) of the Kota district, followed by Gopalpura village (35%) of the Baran district. The maximum per cent disease intensity (PDI) of stem gall disease was observed in Ramganj Mandi (47.5%) of Kota district, followed by stem gall disease PDI in Shahbad (37.5%) and Anta (32.5%) of Baran district. The minimum PDI was recorded in Kanwas (10.0%) of Kota district, followed by Nadi Khod village (12.5%) and Jarga village (15.0%) of Jhalawar district and Gopalpura (15.0%) of Baran.

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Introduction

Spices play an important role in food and nutrition not only as condiments but also in the Indian agricultural economy owing to medical, industrial and processing points of view. India is known as the "Bowl of Spices", and its spices are the best quality in the world. Coriander (*Coriandrum sativum* L.) is an annual herbaceous plant (2n = 22) which belongs to the family Apiaceae and is generally grown in the winter season as the main crop of Rabi season in India (Singh & Verma 2015). It is commonly known as cilantro or dhania or Chinese parsley, originated in the Mediterranean region, and is a highly cross-pollinated crop (Leharwan & Gupta 2019).

It is one of the first spices used by humanity, having been known as early as 5000 BC. Globally, it is cultivated in India, Malaysia, UAE, Singapore, the United Kingdom, South Africa, and Indonesia. India is the largest producer, consumer and exporter of coriander (Saxena & Gandhi 2015) with Madhya Pradesh occupying the first place in area and production among all states followed by Gujarat, Rajasthan, Assam and Andhra Pradesh (Tiwari & Agarwal 2014). Coriander cultivated area is about 628624 ha & 822210 t production in India (Anonymous 2020-21a). In Rajasthan, coriander has been cultivated area of about 124286 ha and production of 182705 t. In

the Hadouti region area is 118030 ha and production of 173764 t (Anonymous 2020-21b). In Rajasthan, the humid south-eastern plain zone (zone V) occupies not only the highest area but also contributes the highest production in the state, to the range of as high as 98 per cent.

Its seeds (fruits) and leaves are extensively used as a natural additive in cooking, added to food to improve its appearance and flavour (Bhat et al. 2014; Singh et al. 2018). All parts of this herb are used as a flavouring agent and as a traditional remedy for the treatment of various diseases and disorders in folk medicine systems of different civilizations (Sahib et al. 2012; Prakhyaath et al. 2022). Coriander oil also has bactericidal and fungicidal properties, so it is used as a carminative, stomachic and spasmolytic. It is also used for diarrhoea, sub-acid gastritis and dyspepsia of diverse genesis as well as for its stomachic, digestive stimulation and antibilious properties (Platel & Srinivasan 2004). Coriander seeds are used as medicine to cure indigestion, dysentery, vomiting, urinary tract infections, and colds (Singh et al. 2007; Das et al. 2023). Pandey (2010) reported that coriander is an essential source of chemicals like alpha-pinene, gamma-terpinene, limonene, cymene, various non-linalool alcohols, esters, flavonoids, coumarins, isocoumarins, phthalides, and phenolic acids. Coriander oil contains coriandrol, girenol and vebriniol. Linalool and linalool-rich essential oils are known to exhibit multiple biological activities such as antimicrobial, anti-inflammatory, anticancer, and antioxidant properties and several in vivo studies have

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confirmed various effects of linalool on the central nervous system.

Coriander is a rich source of niacin, vitamin A, vitamin K, vitamin C, and minerals such as calcium, iron and includes proteins, carbohydrates, fibre, and fats and also provides energy. Its seed contains about 0.1-1 per cent of volatile oil, as an active ingredient. The most important constituents of its seeds are essential oil and fatty oil (Coskuner & Karababa 2007). The demand is gradually increasing because of the medicinal value of seeds, which is gaining importance in view of their inbuilt extractable constituents and their convenient use (Murthy & Sridhar 2001; Thakral et al. 2002; Jakhar & 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 to the vulgare and microsporum groups, respectively. Large-seeded types contain 0.1-0.35% oil content, whereas small-seeded types possess more than 0.4% oil content. It has a strong fragrance and contains essential oil (0.03 to 2.6%). The major compounds present in essential oil are linalool 67.7%, α -pinene 10.5%, γ -terpinene 9.0%, geranyl acetate 4.0%, camphor 3.0%, and geraniol 1.9% (Nadeem et al., 2013).

Protomyces macrosporus Unger is an ascomycete fungus that causes galls on *Aegopodium podagraria*, *Anthriscus sylvestris*, *Angelica sylvestris*, *Daucus carota* and some other members of the family Umbelliferae or Apiaceae, commonly known as umbellifers (Margaret & Shirley 2002). A preliminary survey has shown that more than 50% of yield loss occurs due to this disease in Kota, Bharatpur, Dholpur, Sawai Madhopur, and adjoining areas in Rajasthan (Jain 2018).

Method and Materials

The roving survey for stem gall disease of coriander was conducted from December to March at various stages of crop growth and calculated mean disease incidence and intensity at farmer's coriander fields in Humid South-Eastern Plain Zone - V of Rajasthan viz; Kota, Baran and Jhalawar districts at five villages of each district for recording the incidence of stem gall disease in Rabi 2021-22. For the survey, five farmer fields in each town of each district were selected where coriander crop was grown (Table 1 and Figure 1). The observations on stem gall disease incidence were recorded by throwing a quadrat of one square meter randomly in a field at three places and from each place ten plants were selected randomly for recording observation.

Formulas to be used: -

$$\text{Per cent disease Intensity} = \frac{\text{Sum of all disease rating}}{\text{Total number of plant observed} \times \text{Maximum disease rating}} \times 100$$

$$\text{Per cent Disease Incidence} = \frac{\text{Number of diseased plant}}{\text{Total number of plant observed}} \times 100$$

Table 1. Details of villages and districts selected for the survey in Humid South Eastern Plain Zone – V in Rabi 2021-22

S. No.	District	Villages
1.	Kota	Kalya Khedi
		Ramganj Mandi
		Bamuliya
		Manpura
		Kanwas
2.	Baran	Gopalpura
		Anta
		Shahbad
		Bamuliya Kalan
		Dungri
3.	Jhalawar	Nadi Khod
		Jarga
		Pachpahad
		Soila
		Gadiya

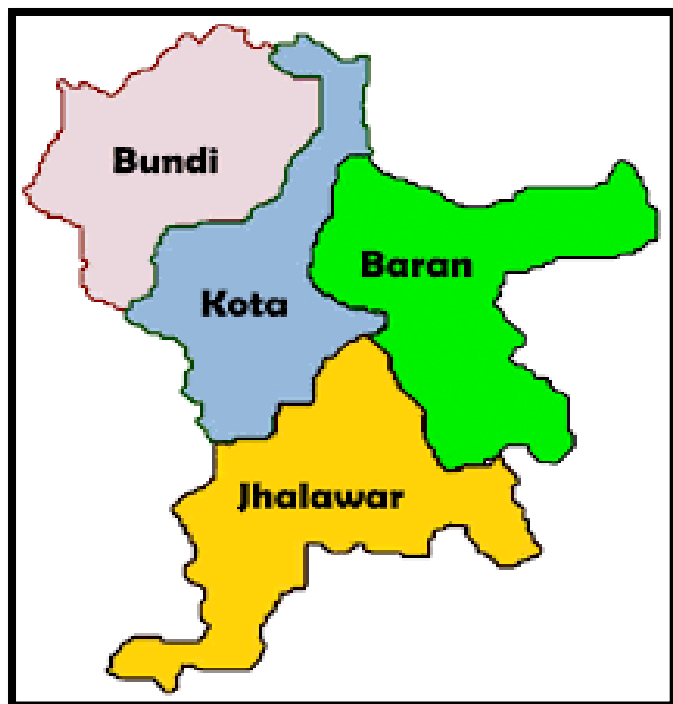


Figure 1. (a) Districts map of Humid South Eastern Plain Zone - V

Result and Discussion

A roving survey was carried out to find out the incidence and intensity of stem gall of coriander from different coriander growing districts of Humid South-Eastern Plain Zone - V of Rajasthan viz., Kota, Baran and Jhalawar districts during *Rabi* season 2021-2022 from December to March at various stages of crop growth and calculated mean disease incidence and intensity has been shown in Table 2 and Figure 1(b), 1(c), 1(d) and 1(e) showed that disease was observed at fifteen locations surveyed in Humid South-Eastern Plain Zone - V of Rajasthan viz; Kota, Baran and Jhalawar districts.

Stem gall incidence: In the Kota district, maximum stem gall disease incidence (70%) was found at Ramganj Mandi followed by Kalya Khedi (60%), Bamuliya (50%), Manpura (40 %) and Kanwas (25%). While, maximum stem gall disease incidence was observed at Gadiya village (50%) of Jhalawar district among the villages surveyed in the district, while the lowest disease incidence was recorded in Jarga village (30%) followed by Soila (38%). In Baran district, maximum stem gall disease incidence was observed in Shahbad (60%)

followed by Anta (55%), Dungri (50%), and Bamuliya Kalan (40%) while the minimum incidence was observed in Gopalpura (35%).

Stem gall maximum per cent disease incidence was recorded in Ramganj Mandi (70%) of Kota district, followed by Kalya Khedi village (60%) of Kota and Shahbad (60%) of Baran district. In contrast, minimum stem gall disease incidence was observed in Kanwas (25%) of the Kota district followed by Gopalpura village (35%) of the Baran district (Table 1.2 & Plate 1.1).

Stem gall disease intensity: In the Kota district maximum stem gall disease intensity (SGDI) (47.5%) was found in Ramganj Mandi followed by Bamuliya (32.0%), Kalya Khedi (27.0%), Manpura (22.5%) and Kanwas (10.0%). In the Jhalawar district, maximum SGDI was observed in Gadiya (25.0%) followed by Pachpahad (17.5%), Soila (15.0%), Jarga (15.0%) and Nadi Khod (12.5%). While, in the Baran district maximum SGDI was found in Shahbad (37.5%) followed by Anta (32.5%), Dungri (25.0%), Bamuliya Kalan (17.5%) and Gopalpura (15.0%).

The maximum SGDI was observed in Ramganj Mandi (47.5%) of Kota district followed by Shahbad (37.5%) and Anta (32.5%) of Baran district. The minimum SGDI was recorded from Kanwas village (10.0%) of Kota district followed by Nadi Khod (12.5%) village and Jarga (15.0%) and Gopalpura (15.0%) of Jhalawar and Baran, respectively (Table 2 & Plate 1).

This disease has been described in all coriander-growing areas of the world such as Scotland, Ireland, Norway, Denmark, Sweden, Nepal, and Germany and in North America, North Africa and South Asia, where the favourable temperature is predominant (Valverde & Templeton 1984; Bhardwaj & Shreshtha 1985). In India, stem gall disease of coriander was reported in Bihar (Sydow & Butler 1911), Madhya Pradesh and adjoining districts of Rajasthan (Gupta 1954), Uttar Pradesh (Singh et al. 1984), Himachal Pradesh (Paul 1992) and Arunachal Pradesh (Bag 1998). Verma et al. (2014) recorded its occurrence from different sites in Jabalpur, Madhya Pradesh. In Himachal Pradesh, the disease intensity of stem gall is between 10.76 to 60 per cent, 0.32 to 7.3 per cent and 0.2 to 2.35 per cent in the district of Kangra, Mandi and Kullu districts, respectively, observed by Paul (1992).

Table 2. Stem gall disease incidence and intensity in Humid South-Eastern Plain Zone - V of Rajasthan during a survey in *Rabi* 2021-22

S. No.	Villages / Locations	Disease Incidence* (%)	Disease Intensity* (%)
District- Kota			
1	Kalya Khedi	60	27.0
2	Ramganj Mandi	70	47.5
3	Bamuliya	50	32.0
4	Manpura	40	22.5
5	Kanwas	25	10.0
Average disease intensity in Kota district = 27.8%			
District- Baran			

1	Gopalpura	35	15.0
2	Anta	55	32.5
3	Shahbad	60	37.5
4	Bamuliya Kalan	40	17.5
5	Dungri	50	25.0
Average disease intensity in Baran district = 25.5%			
District-Jhalawar			
1	Nadi Khod	40	12.5
2	Jarga	30	15.0
3	Pachpahad	45	17.5
4	Soila	38	17.5
5	Gadiya	50	25.0
Average disease intensity in Jhalawar district = 17.5%			

*Average of five farmer fields from each village of districts.



Plate 1. Survey of stem gall disease in farmers' field

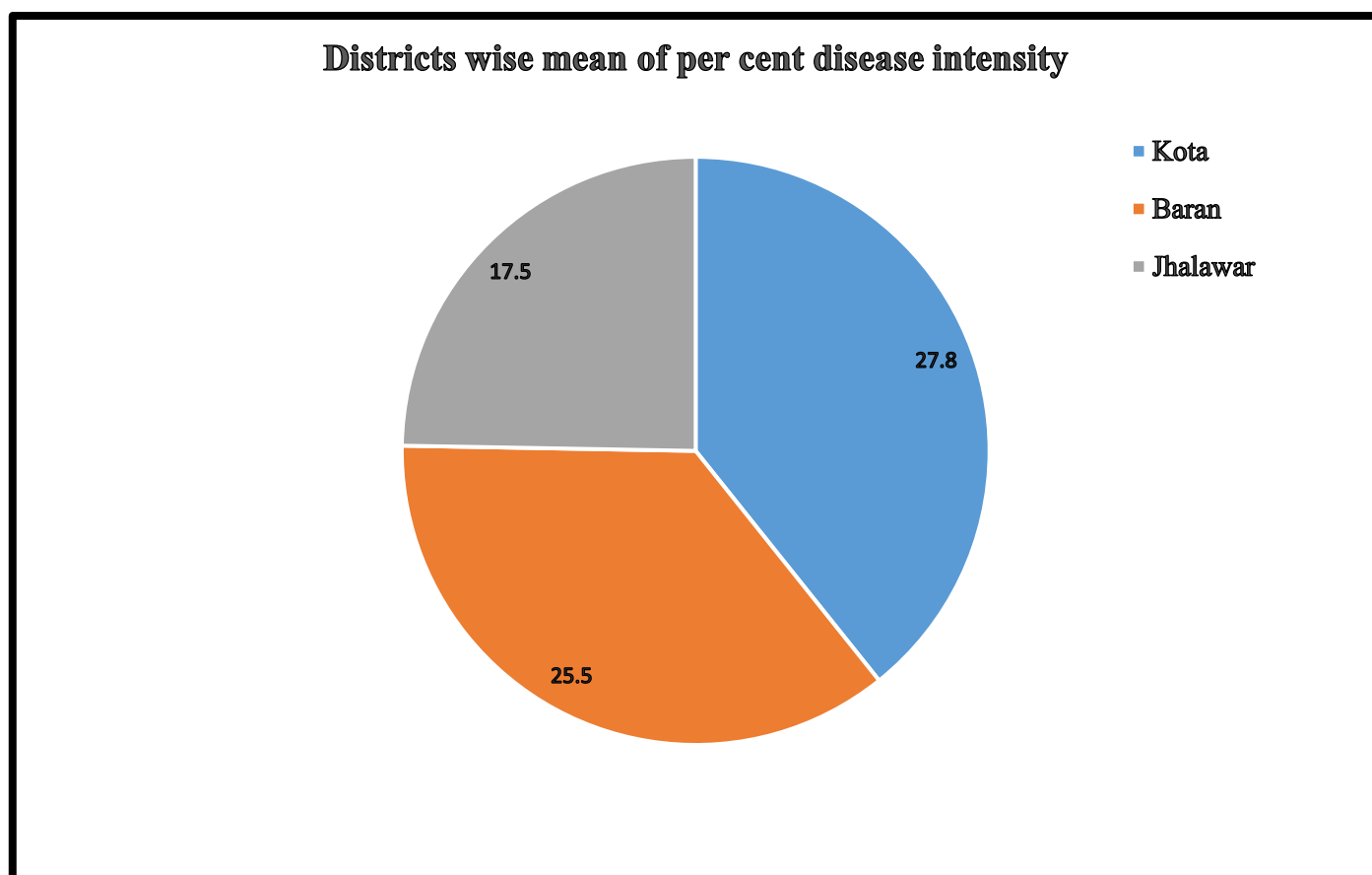


Figure 1(b). Stem gall disease intensity in Humid South-Eastern Plain Zone - V of Rajasthan

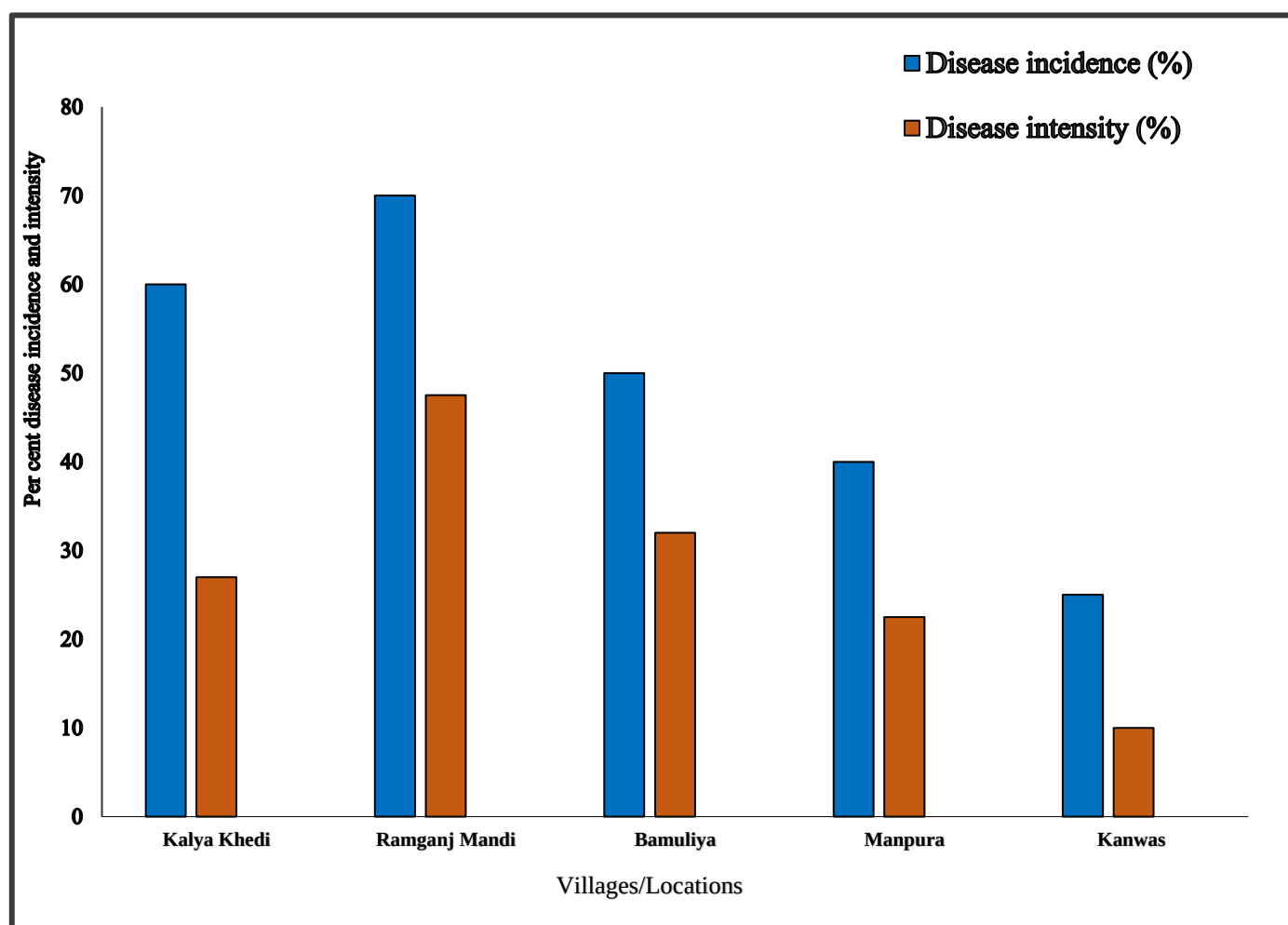


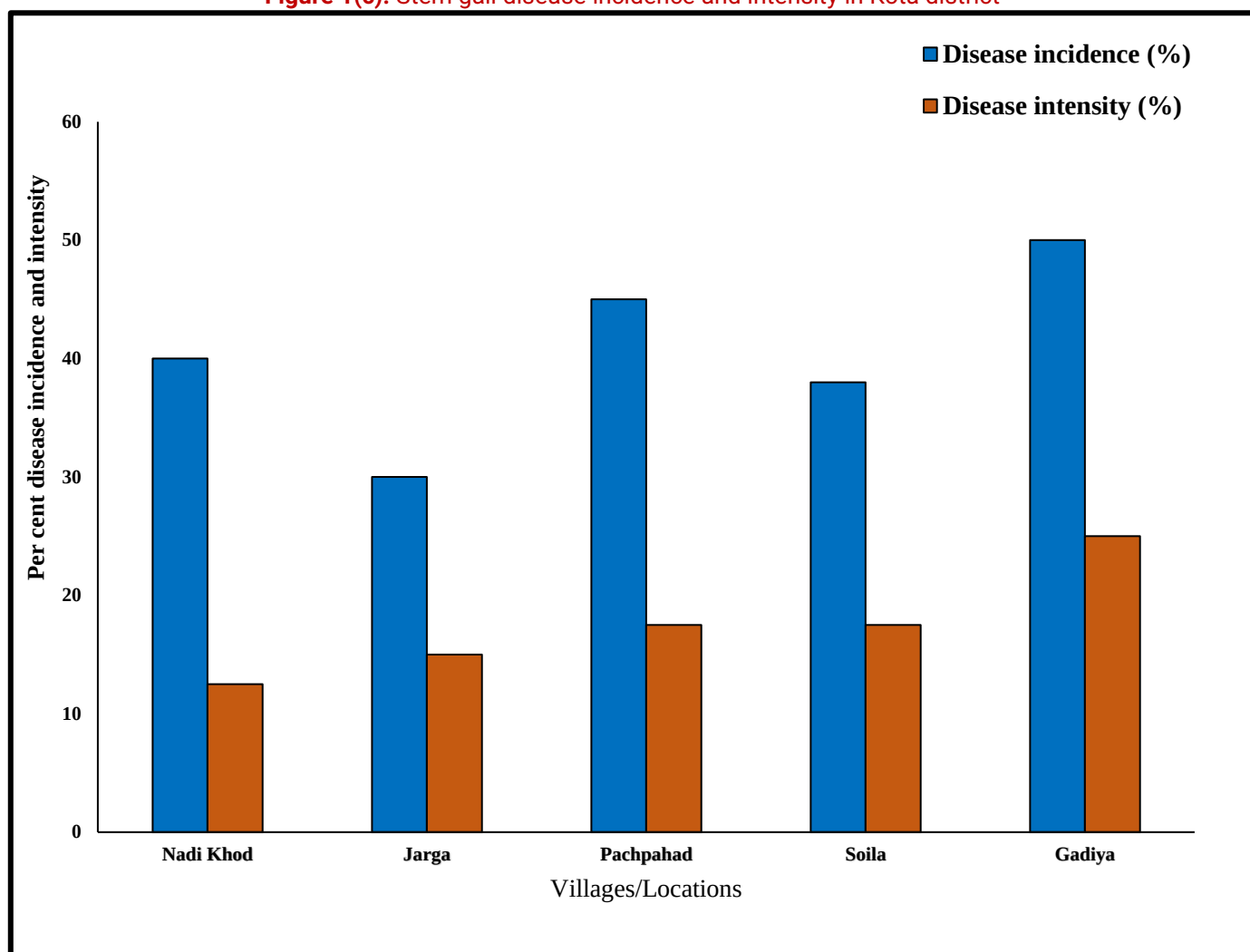
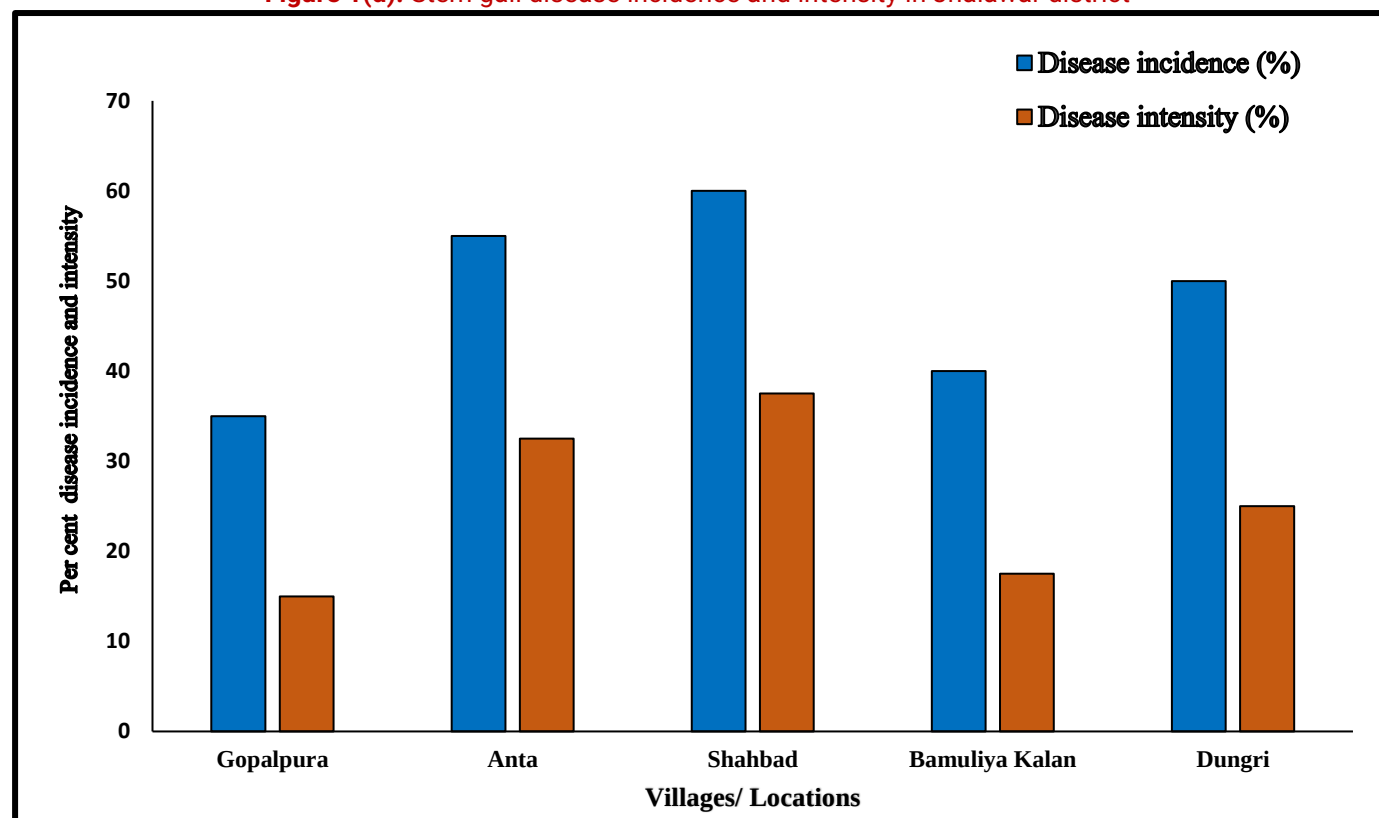
Figure 1(c). Stem gall disease incidence and intensity in Kota district**Figure 1(d).** Stem gall disease incidence and intensity in Jhalawar district

Fig 1(e). Stem gall disease incidence and intensity in Baran district**Declaration of interests**

The authors have no conflict of interest to declare.

Data Sharing

All relevant data are within the manuscript

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