



Infestation of *Quadrastichus erythrinae* Kim (Eulopidae: Hymenoptera) an invasive pest on *Erythrina* spp, a popular standard for black pepper (*Piper nigrum*) in Idukki district in Kerala, India

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ABSTRACT: Black pepper is an important spice crop grown in Kerala state. Idukki and Wayanad districts contribute major share in production of this spice crop. More than 80 percent of pepper vines grown in this area are trailed on *Erythrina* spp. A survey has been conducted to ascertain the severity of gall wasp infestation in *Erythrina* spp. The total number of locations and black pepper gardens covered during the survey include 6 blocks and 37 panchyats in Idukki district of Kerala state. *E. variegata* (dense thorn) could be rated as moderately resistant (Scale 2- 25% infestation and less) and *E. variegata* (white thorn) as less susceptible (Scale 3 – 25 to 50 % infestation). The reaction of different types/species of *Erythrina* to EWG has revealed that the infestation was higher in black thorn type of *E. variegata* where in the infestation was 75 to 100 percent. Chakkupallam, Erattayar, Kanchiyar of Kattappana panchayats recorded maximum infestation since the pepper growers used black thorned type of *E. variegata* as standards.

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KEY WORDS: Black pepper, *Erythria* spp, *Quadrastichus erythrinae*, *Erythrina* Gall Wasp, Idukki

INTRODUCTION

Black pepper is an important spice crop grown in Kerala state. Idukki and Wayanad districts contribute major share in production of this spice crop. More than 80 percent of pepper vines grown in this area are trailed on *Erythrina* spp. The tree is commonly known as coral tree, tiger's – claw, Japanese coral tree is noted for its seasonal showy red flowers. It is generally

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propagated through cuttings. The tree is commonly preferred as standards for trailing pepper on account of its faster growth, supplementation of nutrients, less competition and presence of thorns which helps in easy trailing by pepper plants. *Erythrina* spp were found affected by various pests and diseases. The most devastating one recorded was Erythrina Gall Wasp (EGW) *Quadrastichus erythrinae* Kim. (Eulopidae: Hymenoptera). Severe incidence of *Quadrastichus erythrinae* has been reported from plains of Thiruvananthapuram on *E. stricta*. (Faizal *et al.* 2006) Outbreak of this pest on *Erythrina* spp was recorded all over Idukki district and the problem has actually felt by farmers of Chellarkovil, Kungiripetty and Myladumpara villages of Chakkupallam panchyat, parts of Udumbanchola and Kattapana block panchyat. (Rajkumar *et al.* 2007). He also reported that black thorned type of *Erythrina variegata* was most susceptible compared to other species. Jacob and Devasahayam (2010) reported incidence of EGW in major black pepper areas of Kerala and Karnataka. The survey indicated that EGW was present in all the districts and taluks surveyed in Kerala and Karnataka.

The incidence and severity of damage caused by EGW significantly varied on various *Erythrina* spp and also on various types of *E. variegata*. Narayana and Dhanya (2011) reported that there was a reduction in the incidence of the pest since the farmers used alternative standards for trailing pepper. An extensive survey in all panchyats of Idukki district for this invasive pest was lacking and hence the survey has been undertaken. The results revealed that the EGW was present in all six blocks and thirty seven panchyats of Idukki district in Kerala. The percentage of trees infested by EGW was higher in Kattapana block (25.4 %) followed by Nedumkandam (23 %) which were in turn on par with Idukki (21.9), Thodupuzha (15.0 %) and Adimali blocks (14.9 %). The thorn less or less thorn type of *E. subumbrans* was found to be free of infestation by EGW.

MATERIALS AND METHODS

A survey has been conducted during 2010-11 to ascertain the severity of gall wasp infestation in *Erythrina* spp. The total number of locations and black pepper gardens covered during the survey include 6 blocks and 37 panchyats in Idukki district of Kerala state. The black pepper gardens in various panchyats were selected from prominent growers of black pepper who use *Erythrina* spp. as standards for trailing black pepper. From each garden, 15 trees were selected at random and the number of trees with symptoms of damage was recorded and the total number of twigs available and number infested was also recorded to calculate the percentage of trees/twigs infested in each garden. The percentage of trees/ twigs infested was also calculated for each panchyat and each block of Idukki district.

A scale has been developed to measure the infestation of gallwasp. Three species of *Erythrina* namely *E. variegata*, *E. subumbrans* (Thorn less or less thorned) and *E. stricta* were generally used as standards and further three distinct types of *E. variegata* namely, black-thorn type, white-thorn type and white dense-thorn type were also found to occur in different panchayats of Idukki District Kerala India. The reaction of different species/type of *Erythrina* was also studied by developing a scale based on the percent infestation of the twigs by EGW. The rating is as follows.

Scale	Cataegory	Severity of twig infestation
1	Resistant	No infestation
2	Moderately Resistant	25% infestation and less
3	Less Susceptible	25-50 % infestation
4	Susceptible	50 - 75 % infestation
5	Highly Susceptible	75-100 % infestation

RESULTS AND DISCUSSION

The results revealed that the EGW, *Quadrastichus erythrinae* Kim. was present in all six blocks and thirty seven panchyats of Idukki district in Kerala. The percentage of trees infested by EGW was higher in Kattapana block (25.4 %) followed by Nedumkandam (23 %) which were in turn on par with Idukki (21.9), Thodupuzha (15.0 %) and Adimali blocks (14.9 %). The

Table.1 Areas surveyed for the incidence of EGW, *Quadrastichus erythrinae* on *Erythrina* spp.

Block	Panchyat	No. of locations	No. of gardens
Idukki	Arakkulam	5	12
	Kanjikuzhi	4	10
	Kamakshi	7	12
	Mariapuram	5	10
	Vathikudy	4	11
	Vazhatoppu	5	12
Kattapana	Aiyappancovil	5	10
	Chakkupallam	8	15
	Erattyar	8	15
	Kanchiyar	5	15
	Kattappana	8	12
	Upputhara	4	12
	Vandanmadu	2	12

Nedumkandam	Karunapuram	5	10
	Nedumkandam	8	12
	Pampadumpara	8	3
	Rajakkad	5	1
	Rajakumari	5	1
	Senapathy	5	1
	Udumbanchola	8	1
Thodupuzha	Edavetty	5	2
	Karikunnam	5	1
	Kumaramangalam	5	1
	Manakkad	5	1
	Muttom	5	1
	Purapuzha	4	1
Adimali	Adimali	5	2
	Bisonvalley	5	2
	Konnathady	4	2
	Pallivasal	4	2
	Vellathuval	5	2
Azutha	Elappara	5	2
	Kokkayar	5	2
	Kumily	5	2
	Peerumedu	5	2
	Peruvanthanam	5	2
	Vandiperiyar	5	2

percentage of twigs infested by EGW was higher in Kattapana block (15.5 %) followed by Nedumkandam (15.0 %) which were on par with Idukki (14.0 %) and Thodupuzha (11.1 %) (Table 2).

Table. 2 Incidence of EGW, *Quadrastichus erythrinae* on *Erythrina* spp in major black pepper growing blocks of Idukki District.

Blocks	Mean per cent infestation	
	Tree	Twig
Idukki	21.9 ^{ab}	14.0 ^{ab}
Kattapana	25.4 ^b	15.5 ^b
Nedumkandam	23.8 ^b	15.0 ^b
Thodupuzha	15.0 ^{ab}	11.1 ^{ab}
Adimali	14.9 ^{ab}	10.0 ^a
Azutha	13.7 ^a	9.7 ^a

Means followed by the same letter are not significantly different in Duncans test P = 0.01

Among the panchyats, the percentage of trees infested by EGW was significantly higher in Chakkupallam (37.2 %) followed by Udumbanchola (35.6), Erattayar (35.3 %) and Karunapuram panchyats (32.3 %). The trees infested by EGW was significantly lower in Rajakumari Panchyat (10.2 %). The percentage of twigs infested by EGW was significantly higher in Erattayar (27.8 %) followed by Udumbanchola (22.6 %), and Chakkupallam (22.2 %) which were on par in all other panchyats except Bison Valley (6.8 %), Peerumedu (7.8 %), Peruvanthanam (8.0 %), Purapuzha (8.3 %), Manakkad (9.2 %) and Kumuly 9.3% (Table 4). Rajkumar *et al.* (2007) reported an outbreak of pest on *Erythrina* spp all over Idukki district and severe in Chellarkovil, Kungiripetty and Myladumpara villages of Chakkupallam panchyat, parts of Udumbanchola and Kattapana block panchyat. Jacob and Devasahayam (2010) reported incidence of EGW in major black pepper areas of Kerala and Karnataka. The survey indicated that EGW was present in all the districts and taluks surveyed in Kerala and Karnataka.

The reaction of different types/species of *Erythrina* to EWG has revealed that the infestation was higher in black thorn type of *E. variegata* where in the infestation was 75 to 100 percent. This was in accordance with the findings of Rajkumar *et al.* (2007). The pest infestation was less than 25 per cent in dense thorn type of *E. variegata*. The infestation was 25 to 50 percent in the white thorn type of *E. variegata*. The thorn less or less thorn type of *E. subumbrans* was found to be free of infestation by EGW. Jacob and Devasahayam (2010) reported the incidence and severity of damage caused by EGW significantly varied on various *Erythrina* spp and also on various types of *E. variegata*.

The rating of resistance / susceptibility of various species/ types of *Erythrina* to EGW based on the percentage of damaged twigs indicating that *E. subumbrans* thorn less type could be

Table. 3 Reaction of *Erythrina* spp to *Quadrastichus erythrinae*

Scale	Cataegory	Severity	Species/Type
1	Resistant	No infestation	<i>E. subumbrans</i> (Thorn less/ Less thorn)
2	Moderately Resistant	25% infestation and less	<i>E. variegata</i> (Dense thorn)
3	Less susceptible	25-50 % infestation	<i>E. variegata</i> (White thorn)
4	Susceptible	50 - 75 % infestation	Nil
5	Highly Susceptible	75-100 % infestation	<i>E. variegata</i> (Black thorn)

Table. 4 Incidence of EGW, *Quadrastichus erythrinae* on *Erythrina* spp in major black pepper growing panchyats

Block	Panchyat	Per cent mean Damage	
		Tree	Twig
Idukki	Arakkulam	23.5 ^{ab}	13.2 ^{ab}
	Kanjikuzhi	28.2 ^{ab}	18.5 ^{ab}
	Kamakshi	12.5 ^a	10.6 ^{ab}
	Mariapuram	23.5 ^{ab}	13.5 ^{ab}
	Vathikudy	25.6 ^{ab}	15.6 ^{ab}
	Vazhatoppu	18.2 ^a	12.2 ^{ab}
Kattapana	Aiyappancovil	27.2 ^{ab}	12.5 ^{ab}
	Chakkupallam	37.2 ^b	22.2 ^b
	Erattayar	35.3 ^b	27.8 ^b
	Kanchiyar	22.3 ^{ab}	13.6 ^{ab}
	Kattappana	25.5 ^{ab}	10.2 ^{ab}
	Upputhara	15.3 ^a	12.3 ^{ab}
	Vandanmadu	15.3 ^a	10.2 ^{ab}

Nedumkandam	Karunapuram	32.3 ^b	13.6 ^{ab}
	Nedumkandam	28.9 ^{ab}	18.5 ^{ab}
	Pampadumpara	25.6 ^{ab}	12.6 ^{ab}
	Rajakkad	13.6 ^a	10.3 ^{ab}
	Rajakumari	10.2 ^a	12.1 ^{ab}
	Senapathy	20.1 ^{ab}	15.2 ^{ab}
	Udumbanchola	35.6 ^b	22.6 ^b
Thodupuzha	Edavetty	23.2 ^{ab}	11.2 ^{ab}
	Karikunnam	13.3 ^a	12.1 ^{ab}
	Kumaramangalam	13.6 ^a	10.3 ^{ab}
	Manakkad	12.6 ^a	9.2 ^a
	Muttom	12.3 ^a	15.6 ^{ab}
	Purapuzha	15.2 ^a	8.3 ^a
Adimali	Adimali	23.5 ^{ab}	10.6 ^{ab}
	Bisonvalley	14.5 ^a	6.8 ^a
	Konnathady	13.5 ^a	10.6 ^{ab}
	Pallivasal	15.6 ^a	11.6 ^{ab}
	Vellathuval	22.4 ^{ab}	10.2 ^{ab}
Azutha	Elappara	12.3 ^a	10.5 ^{ab}
	Kokkayar	15.6 ^a	12.5 ^{ab}
	Kumily	13.3 ^a	9.3 ^a
	Peerumedu	15.3 ^a	7.8 ^a
	Peruvanthanam	12.6 ^a	8.0 ^a
	Vandiperiyar	13.3 ^a	10.3 ^{ab}

Means followed by the same letter are not significantly different in Duncans test P = 0.01

classified as resistant (Scale 1- No infestation) and *E. variegata* (black thorn type) highly susceptible (Scale 5- Highly susceptible) 75-100 % infestation. *E. variegata* (dense thorn) could be rated as moderately Resistant (Scale 2- 25% infestation and less) and *E. variegata* (white thorn) as less susceptible (Scale 3 – 25 to 50 % infestation).

Chakkupallam, Eratatyar, Kanchiyar of Kattappana panchayats recorded maximum infestation since the pepper growers used black thorned type of *E. variegata* as standards. Messing *et al* (2008) screened 71 species of *Erythrina* in Hawaii to EGW infestation based on field observations and sleeve- cage experiments, and found that 12 species were free from attack. It has been observed that EWG is an important limiting factor for successful cultivation of black pepper since *Erythrina* sp with thorns were ideal for trailing black pepper. In many gardens the infestation of EGW along with borer pest has resulted in death of *Erythrina* standards. Pepper growers were reluctant in using alternate standards and this has resulted in decline in area of black pepper in many areas of Idukki district.

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