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Pest scenario and their abundance in grape ecosystem

Sunitha ND**Abstract**

Agricultural production is not natural and viticulture is no exception. These production systems are constantly challenged by biotic and abiotic stresses and insect pests are key contenders. Grape being a perennial fruit crop is a host for more than hundred insect pests. In an attempt made to study the pest scenario during 2015-16 and 16-17 in grape orchards of Vijayapura district of Karnataka state, total of 24 species of insect pests from seven orders and two species of mite pests were recovered. Six species of order Coleoptera, six species of order Lepidoptera, four species of order Hemiptera, three species of order Hymenoptera, three species of order Thysanoptera, one species from order Isoptera and one species from order Diptera and two species from Acari were recorded. Among them eight species were abundant during both the years of study. Out of twenty six species of pests recorded, eight species were found to be major pests, three species were found to be minor and fifteen species were found as negligible pests.

Keywords: Grape, pest scenario, abundance, pest status**Introduction**

Grape (*Vitis vinifera* L.) is one of the most important fruit crops of temperate zone which has acclimatized to tropical and sub-tropical agro climatic conditions. Grape is grown under a variety of soil and climatic conditions in three distinct agro-climatic zones namely, subtropical, hot tropical and mild tropical climatic regions in India. At present grape is cultivated in an area of 45,200 ha with an annual production of 10.57 lakh tones. Maharashtra stands first with 29,800 ha followed by Karnataka having 8200ha with an annual production of 7.79 and 2.28 lakh tones respectively ^[1]. Grape growing regions are located in two agro-climatic regions in the state viz., North Interior Karnataka and South Interior Karnataka. North Interior Karnataka comprises Vijayapura, Bagalkot, Belgaum, Koppal, Bidar and Gulbarga districts. In 2015-16, Vijayapura district contributed an area of 10562 ha, production of 211640 tons, with average productivity 20 tons/ha.

Agricultural production is not natural, and viticulture is no exception. These production systems are constantly challenged by biotic and abiotic stresses and insect pests are key contenders. More than 85 species of insects have been reported on grapevine in India ^[2]. A total of 22 insect pests are found to attack grapevine in northern Karnataka ^[3]. A total of 40 vertebrates (Birds-27, bat-2, snails and slugs -5, rodents-6) were recorded as pests of grapes in different countries. Among them birds and bats are known to cause significant damage. Mites numbering 41 and nematodes numbering 113 were recorded as pests of grapes. A total of 459 insects (Dermaptera-2, Orthoptera-17, Isoptera-12, Hemiptera-116, Thysanoptera-34, Lepidoptera-106, Diptera-12, Hymenoptera-26, Coleoptera-134) is known to attack different parts of grapevine. Overall 653 pests are known to damage the crop in different grape growing regions of the world. More than 100 pests are known to attack the grapes in India ^[4]. As many as 132 insects are known to attack grape in the world and 100 insects and mites are known to damage grape in India. Of these only 15-20 species are considered to cause losses in various parts ^[1]. 12 species of insect pests were recorded on grapes in Vijayapura district which included 4 species of Homoptera, 3 species of Thysanoptera, one species of acari, two species of Coleoptera and two species of Lepidoptera ^[5]. As much as 80% economic yield loss is reported on grapes due to pests in India ^[6].

Incidence of pests is related to several cultural practices like pruning, training system, irrigation, nutrition, thinning of berries and harvesting time. Along with these, climate also plays significant role in the incidence of pests.

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Abrupt environmental changes as induced by current climatic variability are likely to exert greater influence on pests and natural enemies than the gradual climate change. Elevated atmospheric CO₂ levels, increased temperatures and shifts in precipitation effect their interactions between plants, insect herbivores and natural enemies in diverse ways that are difficult both to understand and predict. Considering the above points, effort has been made to study the pest scenario and the abundance of these pests and document their pest status in grape orchards of Vijayapura, Karnataka during 2015-16 and 2016-17.

2. Material and Methods

Studies of occurrence of important pests of grape, their abundance and pest status were carried out at three locations of Vijayapura district during 2015-16 and 2016-17. Area of one acre in each location planted with Thompson seedless variety was chosen for the study. For the purpose of study light traps were installed @ 1 trap/acre. One acre area is divided into five uniform blocks and yellow sticky traps were used @ 1 trap /block and 5 traps /acre. Traps were replaced once in 15 days. Observations on number of insects and degree of crop damage were recorded once in 15 days throughout the year. After each collection, insects were counted and sorted out based on their taxonomic position and preserved.

2.1. Abundance

The collected insects were categorized into 5 groups (Abundant- Greater than/equal to 30%, Common -20 to 29%, Frequent -10 to 19%, Occasional -5to10% and rare-1 to 4% of total population made during both years of study at three locations.^[7]

2.2. Pest Status

To study the pest status, degree of damage done by each pest is considered. Accordingly they are classified as major pests (More than 10% crop damage) minor pests (5-10% crop damage) and negligible pests(Less than 5% damage).

3. Results and Discussion

3.1. Pest Species

The important species of insect pests and mite pests recorded during the study period and their taxonomic position is presented in Table 1. The number species recorded from each order is represented in Fig 1.

Insect pests belonging to order Coleoptera (*Celosterna scabrator* Fabr), stem girdler (*Sthenias grisator*. Fab), flea beetle (*Scelodonta strigicollis* Mots), Ash weevil (*Mylocherus* sp.) Root grub (*Holotrichia serrata* (Fab.) and shot hole borer (*Xyleborus* sp), order Thysanoptera (*Scirtothrips dorsalis* Hood, *Thrips. palmi* Karny and *Thrips hawaiiensis* Morgan), order Lepidoptera (*Hippotion celerio* Linn, *Achoea janata* Linn, *Ophiderus fullonica* Linn. *O. materna* Moore, *Helicoverpa armigera* (Hubner) and *Spodoptera litura* Fabr), order Hemiptera (*Planococcus citri* (Risso), *Maconellicoccus hirsutus* (Green), *Ferrisia* sp and *Empoasca* sp), order Diptera (*Bactrocera* sp), order Hymenoptera (*Polistes* sp, *Vespa* sp and *Apis mellifera*), order Isoptera (*Odontotermes* sp.) and mite pests from Acari (*Tetranychus cinnabarinus* (Boisd.) and *Tetranychus. neocaledonicus*. Andre) were recorded from the

study areas during both the seasons. Order Lepidoptera and Order Coleoptera recorded maximum number of insect pest species. (6.00) which is followed by order Hemiptera (4.00), order Hymenoptera (3.00), order Thysanoptera (3.00), order Diptera (1.00) and order Isoptera (1.00) and two species of mites from acari were recorded during the study period. A total of 24 insect pest species and 2 mite species were recorded during the study period.

3.2. Pest Abundance

The data on the abundance of pests recorded during the study period is presented in table 2.

Order Coleoptera

Stem borer and stem girdler adults were more abundant between July–October. While stem borer was abundant during both the years of study stem girdler was rare during 2015-16 but abundant during 2016-17. Flea beetles were more abundant during May to September and December to January during both years. Ash weevils were frequently observed in few numbers during 2015-16 but rarely seen during 2016-17 and root grubs were sporadic in their occurrence and rarely seen during both the years. Shot hole Borer is rare on dead vines.

Order Thysanoptera

Three species of thrips were abundant between November to March during both the years.

Order Lepidoptera

All the six species of Lepidoptera were commonly appeared between October to April during both the years of study.

Order Hemiptera

Three species of mealy bugs were abundant throughout the year during 2015-16 but not abundant during 2016-17 but observed frequently. Leaf Hopper appeared occasionally during both the years of study.

Orders Diptera, Hymenoptera and Acari

Fruit Fly, Wasps and Honey bees were frequently observed during berry ripening period but not abundant during both the years of study. Two red spider mite species were occasionally observed during 2015-16 and rarely noticed during 2016-17.

3.3. Pest status

The data on status of pests recorded from grape orchards of Vijayapura district is presented table 3. Out of twenty six species of pests recorded, eight species were found be major pests (*Celosterna scabrator* Fabr, *Sthenias grisator*. Fab, *Scirtothrips dorsalis* Hood, *Thrips. palmi* Karny, *Thrips hawaiiensis* Morgan, *Maconellicoccus hirsutus* (Green), *Planococcus citri* (Risso), *Ferrisia* sp), three species were found to be minor (*Tetranychus cinnabarinus* (Boisd.), *Tetranychus. neocaledonicus*. Andre and *Scelodonta strigicollis* Mots). *Mylocherus* sp. *Xyleborus* sp, *Holotrichia serrata* (Fab.), *Hippotion celerio* Linn, *Achoea janata* Linn, *Ophiderus fullonica* Linn., *O. materna* Moore, *Helicoverpa armigera* (Hubner), *Spodoptera litura* Fabr, *Odontotermes* sp, *Empoasca* sp, *Bactrocera* sp, *Polistes* sp, *Vespa* sp and *Apis mellifera* L., were found to be negligible pests.

Table 1: Insect pests of grape ecosystem in Vijayapura District

S. No	Order	Common Name	Scientific Name	Family
1	Coleoptera	Stem Borer	<i>Celosterna scabrator</i> Fabr	Ceram Bycidae
		Stem Girdler	<i>Sthenias grisator.</i> Fab	Ceram Bycidae
		Flea Beetle	<i>Scelodonta strigicollis</i> Mots	Eumolphidae
		Ash weevil	<i>Mylocerus</i> sp.	Curculionidae
		Shot hole Borer	<i>Xyleborus</i> sp	Scolytidae
		Root Grub	<i>Holotrichia serrata</i> (Fab.)	Scarabaeidae
2.	Thysanoptera	Thrips	<i>Scirtothrips dorsalis</i> Hood	Thripidae
		Thrips	<i>Thrips. palmi</i> Karny	Thripidae
		Thrips	<i>Thrips hawaiiensis</i> Morgan	Thripidae
3.	Lepidoptera	Hawk moth Horn Caterpillar	<i>Hippotion celerio</i> Linn	Sphingidae
		Castor semilooper	<i>Achoea janata</i> Linn	Noctuidae
		Fruit sucking moth	<i>Ophiderus fullonica</i> Linn.,	Noctuidae
		Fruit sucking moth	<i>O. materna</i> Moore	Noctuidae
		Berry borer	<i>Helicoverpa armigera</i> (Hubner)	Noctuidae
		Berry Borer	<i>Spodoptera litura</i> Fabr	Noctuidae
4.	.Isoptera	Termite	<i>Odontotermes</i> sp.	Termitidae
5.	Hemiptera	Leaf Hopper	<i>Empoasca</i> sp	Cicadellidae
		Mealy Bug	<i>Maconelicoccus hirsutus</i> (Green)	Pseudococcidae
		Mealy Bug	<i>Planococcus citri</i> (Risso)	Pseudococcidae
		Mealy Bug	<i>Ferrisia</i> sp	Pseudococcidae
6	Diptera	Fruit Fly	<i>Bactrocera</i> sp	Tephritidae
7.	Hymenoptera	Wasp	<i>Polistes</i> sp	Vespidae
		Wasp	<i>Vespa</i> sp	Vespidae
		Honey bee	<i>Apis mellifera</i> L.,	Apidae
8	Acari	Red Spider Mite	<i>Tetranychus cinnabarinus</i> (Boisd.)	Tetranychidae
		Red Spider Mite	<i>Tetranychus. neocaledonicus.</i> Andre	Tetranychidae

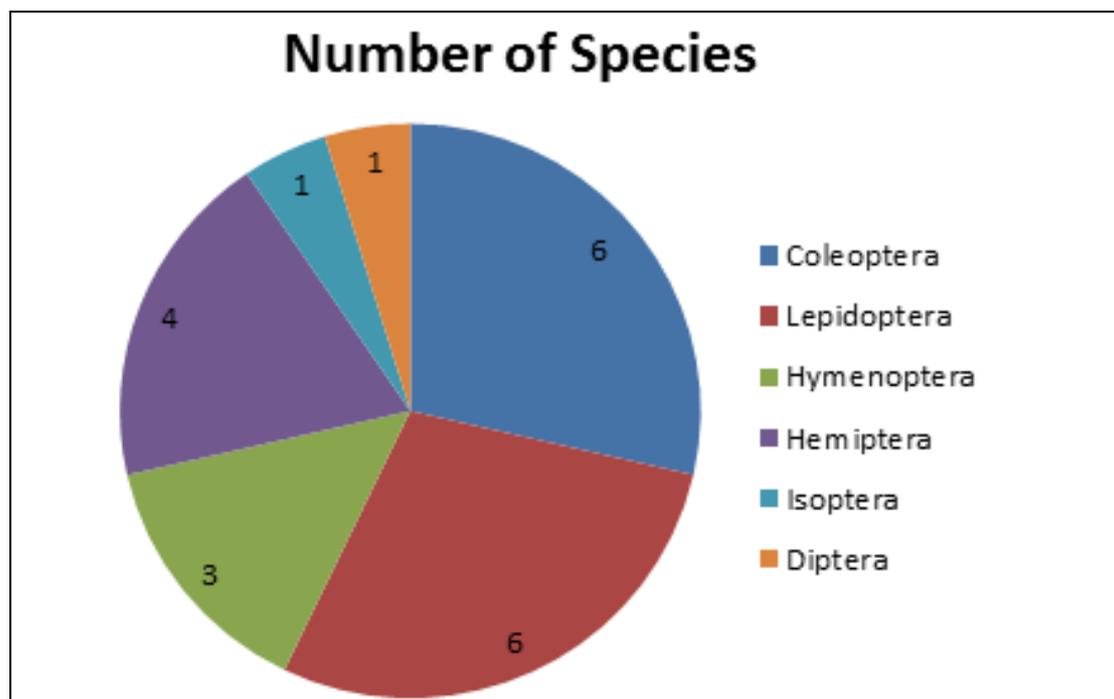


Fig 1: Number of species of pests recorded from grape ecosystem

Table 2: Abundance of pests in grape ecosystem

		2015-16	2016-17
A	Abundant	<i>Celosterna scabrator</i> Fabr <i>Scirtothrips dorsalis</i> Hood, <i>Thrips. palmi</i> Karny <i>Thrips hawaiiensis</i> Morgan <i>Planococcus citri</i> (Risso), <i>Maconellicoccus hirsutus</i> (Green) <i>Ferrisia</i> sp <i>Scelodonta strigicollis</i> Mots	<i>Scelodonta strigicollis</i> Mots <i>Celosterna scabrator</i> Fabr <i>Scirtothrips dorsalis</i> Hood, <i>Thrips. palmi</i> Karny <i>Thrips hawaiiensis</i> Morgan
C	Common	<i>Hippotion celerio</i> Linn, <i>Achoea janata</i> Linn, <i>Ophiderus fullonica</i> Linn. <i>O. materna</i> Moore, <i>Helicoverpa armigera</i> (Hubner) <i>Spodoptera litura</i> (Fabr.)	<i>Hippotion celerio</i> Linn, <i>Achoea janata</i> Linn, <i>Ophiderus fullonica</i> Linn. <i>O. materna</i> Moore, <i>Helicoverpa armigera</i> (Hubner) <i>Spodoptera litura</i> Fabr)
F	Frequent	<i>Myllocerus</i> sp <i>Bacrocera</i> sp <i>Vespa</i> sp <i>Polistes</i> sp <i>Apis mellifera</i>	<i>Planococcus citri</i> (Risso), <i>Maconellicoccus hirsutus</i> (Green) <i>Ferrisia</i> sp <i>Bacrocera</i> sp <i>Vespa</i> sp <i>Polistes</i> sp <i>Apis mellifera</i>
O	Occasional	<i>Tetranychus neocaledonicus.</i> Andre <i>Tetranychus cinnabarinus</i> (Boisd.) <i>Empoasca</i> sp	<i>Empoasca</i> sp
R	Rare	<i>Myllocerus</i> sp <i>Holotrichia serrata</i> (Fab.) <i>Sthenias grisator.</i> Fab <i>Xyleborus</i> sp	<i>Myllocerous</i> sp <i>Holotrichia serrata</i> (Fab.) <i>Tetranychus neocaledonicus.</i> Andre <i>Tetranychus cinnabarinus</i> (Boisd.) <i>Myllocerus</i> sp <i>Xyleborus</i> sp

Table 3: Pest status in grape ecosystem of Vijayapura District

S. No	Common Name	Scientific Name	Pest Status
1	Stem Borer	<i>Celosterna scabrator</i> Fabr	Major
2	Stem girdler	<i>Sthenias grisator.</i> Fab	Major
3	Thrips	<i>Scirtothrips dorsalis</i> Hood	Major
4	Thrips	<i>Thrips. palmi</i> Karny	Major
5	Thrips	<i>Thrips hawaiiensis</i> Morgan	Major
6	Mealy Bug	<i>Maconellicoccus hirsutus</i> (Green)	Major
7	Mealy Bug	<i>Planococcus citri</i> (Risso)	Major
8	Mealy Bug	<i>Ferrisia</i> sp	Major
9	Flea Beetle	<i>Scelodonta strigicollis</i> Mots	Minor
10	Red Spider Mite	<i>Tetranychus cinnabarinus</i> (Boisd.)	Minor
11	Red Spider Mite	<i>Tetranychus. neocaledonicus.</i> Andre	Minor
12	Ash weevil	<i>Myllocerus</i> sp.	Negligible
13	Shot hole Borer	<i>Xyleborus</i> sp	Negligible
14	Root Grub	<i>Holotrichia serrata</i> (Fab.)	Negligible
15	Hawk moth Horn Caterpillar	<i>Hippotion celerio</i> Linn	Negligible
16	Castor semilooper	<i>Achoea janata</i> Linn	Negligible
17	Fruit sucking moth	<i>Ophiderus fullonica</i> Linn.,	Negligible
18	Fruit sucking moth	<i>O. materna</i> Moore	Negligible
19	Berry borer	<i>Helicoverpa armigera</i> (Hubner)	Negligible
20	Berry Borer	<i>Spodoptera litura</i> Fabr.	Negligible
21	Termite	<i>Odontotermes</i> sp.	Negligible
22	Leaf Hopper	<i>Empoasca</i> sp	Negligible
23	Fruit Fly	<i>Bactrocera</i> sp	Negligible
24	Wasp	<i>Polistes</i> sp	Negligible
25	Wasp	<i>Vespa</i> sp	Negligible
26	Honey bee	<i>Apis mellifera</i> L.,	Negligible

In the present study 24 species of insect pests and two species of mite pests were recorded.

[1]-reported that the pest complex in grapes include the sucking insect pests namely thrips, hoppers, mealybugs and beetle pests like stem borer, stem girdler, flea beetles, chafer beetles, shot hole borer and several lepidopteron and mites which are similar to the findings of present study. The present findings

are also in agreement with the findings of [3] who reported that 22 insect pests are known to attack grapevine in northern Karnataka and. [5] who reported that 12 species of pests attack grape in Vijayapura which included 4 species of Homoptera, 3 species of Thysanoptera, one species of acari, two species of Coleoptera and two species of Lepidoptera

In the present study 8 species of pests were found to be major

which included three species of thrips, three species of mites, stem borer and stem girdler [3] reported that out of 22 pests recorded from northern Karnataka two species viz, Flea beetle, *Sceledonta strigicollis* Mots. and Mealy bug, *Maconellicoccus hirsutus* (Green) were recorded as major pests whereas three insects viz., Stem girdler, *Sthenias grigator* Fab., Stem borer, *Coelostema scabrator* (F.) and Leaf worm, *Spodoptera litura* Fab. were recorded as moderate pests and as many as thirteen insect pests were recorded as minor pests on this crop, while four were recorded as negligible pests. The present findings on the pest status are partially similar to the reports of [3, 8] reported that the stem borer *C. scabrator* is a major pest of grape which is similar to the present findings [2] reported that more than 85 species of insect pests attack grape in India and [3] stated that more than 100 pests are known to attack grape in India. As reported by [1] thrips, mealy bugs, stem borers, mites, flea beetles and leaf and bunch eating caterpillars are important pests in grape which are similar to the present findings. In the present study two species of mites are recorded. While [7] reported Six species of mites viz., *Tetranychus urticae*, *T. cinnabarinus*, *T. neocaledonicus*, *Oligonicus mangiferus*, *O. unicae* and *Eutetranychus orientalis* are found causing damage to grapevine in India. Among them, the two spotted red spider mite *T. urticae* causes severe loss in Maharahtara, Karnataka and Andhra Pradesh. [8].

The distribution of grape pests is influenced by several factors like variations in the climate, soil, rootstocks, natural enemies, elevation and isolation, cultural practices and pest management strategies. [1].

4. Conclusion

In the present study 26 species of pests were recorded from the grape ecosystem.

The results of present study on pest complex, abundance and pest status are not similar with the other findings as incidence of pests is related with several cultural practices like pruning, training system, irrigation, nutrition, thinning of berries and harvesting time and pesticide usage patterns. Along with these, climate also plays significant role in the incidence of pests. Abrupt environmental changes as induced by current climatic variability are likely to exert greater influence on pests and natural enemies than the gradual climate change. Elevated atmospheric CO₂ levels, increased temperatures and shifts in precipitation effect their interactions between plants, insect herbivores and natural enemies in diverse ways. Long term studies on population dynamics and effect of biotic and abiotic factors on pest abundance, pest status and natural enemies will help in developing effective forecasting models.

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