Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(4): 836-842

Received: 10-05-2020
Accepted: 12-06-2020

Sunitha ND
Associate Professor,
Dept of Ag. Entomology and Sericulture. College of Agriculture, Vijayapura (UAS, Dharwad), Karnataka, India

Shrikant S Chavan
Professor and Head
Dept of Ag. Entomology and Sericulture. College of Agriculture, Vijayapura (UAS, Dharwad). Karnataka, India

Corresponding Author:
Sunitha ND
Associate Professor,
Dept of Ag. Entomology and Sericulture. College of Agriculture, Vijayapura (UAS, Dharwad), Karnataka, India

Nature and symptoms of damage by *Stromatium barbatum* (Cerambycidae: Coleoptera) a new pest of grapevines in Karnataka

Sunitha ND and Shrikant S Chavan

Abstract
New stem borer was appeared in the grape orchards of Vijayapura district (Karnataka. India). Investigations were carried out on the identity of the pest, its nature of damage, the typical symptoms it produced. The new pest was identified as *Stromatium barbatum.* (Cerambycidae: Coleoptera). Pest deposited eggs in the cracks and crevices on the grape vine. Grubs (0.03-9.35/cordon) formed irregular tunnels and many galleries tightly packed with very fine powdery frass. Under heavy infestations, tunnels and galleries interlaced so the interior of the wood is reduced to fine powder but exterior surfaces were left intact. Creamy white execrate pupae were seen in galleries. Adults immediately after emergence were seen within the galleries or tunnels before they came out by cutting near circular exit holes. Leaves didn't show any symptoms of chlorosis. Cordons loaded with grubs failed to bear fruit bunches. This is the first report on *S. barbatum* on grapes from Karnataka.

Keywords: New pest, grape ecosystem, *Stromatium barbatum*, Karnataka, first report

1. Introduction
Grape is one of the most important fruit crops of India and is cultivated 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, during 2017-18, grape is cultivated in an area of about 1, 39, 000 ha with the production of 29, 20, 000 MT with productivity of 21.00 t $ha^{-1.}$ Karnataka state stands second after Maharashtra with an area of about 26.61 thousand ha with the production of 524.20 thousand MT. (http://agricoop.nic.in/sites/default/files/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf) [1]. Export of 1, 56, 218 MT of grapes was carried out during the year 2015-16. In Karnataka, Vijayapura district ranked first with an area and production of 10,652 ha and 211.64 MT respectively (Anon, 2018). [2].

Biotic and abiotic stresses play vital role in successful cultivation of any crop. Similarly insect pests are one of the important biotic stresses affecting grape production. As many as 132 insects are known to attack grape vines 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 and wood boring beetles are one among them. [Mani *et al* 2014) [3].

A total of thirty one species of beetles under 26 genera, 17 tribes of 4 subfamilies were considered as a pestiferous to agriculture crops. Among them few species are considered as potential pests with extensive host range and have ability to cause loss up to 40-60 per cent in horticulture ecosystems (Kariyanna *et al*., 2017a).

Serious damage caused by wood boring cerambycid beetles in vineyards was reported in Europe [(Galet, 1982) [4], Asia-Pacific region (Azam, 1979 [5].; Ashihara, 1982 [6] ; FAO, 2001 [7]; Jagginavar *et al*., 2006 [8]; Mani *et al.*,2008 [9] ; Salini and Yadav, 2011[10] ; Kariyanna *et al.*, 2017 [11]; Jadhav *et al*., 2017 [12]; Sunitha, 2017 [13]; Yadav *et al*., 2019 [14]]

While Goodwin and Pettit, 1994 [15] and Goodwin, 2005 [16] reported the occurrence of fig longicorn, *Acalolepta vastator* (Newman), causing economic damage to grapevines in Lower Hunter Valley, New South Wales (NSW), Australia, Ocete and Del Tio (1996) [16] reported the occurrence of another serious wood boring beetle ,*Xylotrechus arvicola* (Olivier) from the vine orchards of Spain.

In India, two species of cerambycid wood borers are on record causing serious damage to grape vines in the major grape growing areas including Maharashtra and Northern Karnataka.

One is *Celosterna scabrator* Fab (Jagginavar *et al* 2006, Mani *et al* 2014 and Sunitha 2018) [7, 3, 13]. *Stromatium barbatum* as a new pest on grape vines was reported by Salini and Yadav (2011) [10] from the vine orchards of Maharashtra state (19.75º N, 75.71º E) and later morphometric analysis and DNA bar-coding studies on *S. barbatum* were conducted by Jadhav *et al* (2018) [12].

The new pest *S. barbatum*, which was restricted to the vine orchards of Maharashra state, started appearing in the grape orchards of Vijayapura district of Karnataka state (13º 17' N and 77º 48' E) ,but the grape growers could not able to diagnose the pest due to the facts that ,there were no external symptoms of damage except the gnawing (Kit kat)sound of feeding grubs and other symptoms which were manifested in the later stage, like absence of fruit bunches on the stem borer affected cordons .The pest was never considered as a serious pest till huge crop loss during 2019.

Correct identification of the pest, its biology, and the type of damage are some of the factors that determine which control strategies and methods should be used. So the present studies were undertaken on correct identification of the new wood boring pest of grape vines in Karnataka, the nature and symptoms damage caused by this new pest for the benefit of grape growers, extension workers, scientists working in the same field as such no reports were available on this new pest from Karnataka state and to our knowledge *S. barbatum* is not reported from any part of the world as a pest of grape except from Maharashtra (India)

2. Materials and Methods

The studies were conducted in grape orchards of Sindagi Taluka of Vijayapura district and department of Ag. Entomology, College of Agriculture, Vijayapura (Karnataka) between November 2019 and June 2020. Four grape orchards (Table 1) planted with variety Thompson Seedless on Dogridge rootstock which were attacked by with new cerambycid pest were selected for the study. Percent incidence was recorded every week based on kit kat sound of feeding grubs as detailed by Shalini and Yadav 2011 [10] .Destructive sampling was done every week during which 15 cordons from each orchard were removed and cut open to count the number of grubs, pupae and adults in each cordon. Such damaged vines were tagged after removing the infested cordons every week. Observations were also recorded on external symptoms of damage and internal damage caused by the pest to the grape vines during destructive sampling every week. Pest was identified using keys by Salini and Yadav (2011) [10] and Jadhav *et al* (2018) [12]. Later confirmed by DNA bar coding.

Table 1: Details of grape orchards selected for experiment

Sl. No	Age of the orchard (years)	Spacing between vines (Feet)	Geographic information of orchards
1	8	11×6	16° 91' N, 76°23' E.
2	6	11x6	16° 91' N, 76°23' E.
3	6	10×5	16° 91' N, 76°23' E.
4	5	11×6	16° 91' N, 76°23' E.

3. Results and Discussion

3.1. Per cent vine damage, mean number of grubs, pupae and adults

The new wood boring pest was identified as *Stromatium barbatum* Fabr. based on the earlier reports mentioned in the previous chapter and also by DNA bar-coding. The percent vine damage ranged between 10.00-100.00 per cent among the four orchards. Mean per cent vine damage of four orchards ranged between 53.25 and 65.00(Table 2). Irrespective of the age of the grape vines the pest attacked green live vines in all the orchards studied. The mean number of grubs of four orchards ranged from 0.03 to 9.35 /cordon/week during May and November months respectively. (Table 3). The activity of grubs was rarely observed during the month of May and onwards which indicates that the grubs go for pupation anywhere between last week of April and May first week and adults emerge during May and June months. Mean number of pupae /cordon/week of four orchards ranged between 2.56 and 6.90 and the mean number of adults ranged between 4.96 to 7.85/ cordon/week (Table 4). In a single cordon both pupae and adults and rarely grubs were observed. Adults of *S. barbatum* have staggered emergence pattern distributed over a short period of 1-2 months during May-June and females start ovipositing after mating in week after their emergence.

Table 2: Percent grape vines affected by *S. barbatum*

Date of observation	Per cent Vine damage				
	Orchard 1	Orchard 2	Orchard 3	Orchard 4	Mean
1st week of November 2019	91.00	82.00	10.00	30.00	53.25
2nd week of November 2019	91.00	82.00	10.00	30.00	53.25
3rd week of November 2019	93.00	84.00	10.00	32.00	54.75
4th week of November 2019	95.00	87.00	20.00	32.00	58.50
1st week of December 2019	96.00	89.00	20.00	34.00	59.75
2nd week of December 2019	96.00	91.00	20.00	40.00	61.75
3rd week of December 2019	100.00	92.00	20.00	40.00	63.00
4th week of December 2019	100.00	100.00	20.00	40.00	65.00
1st First week of January 2020	100.00	100.00	20.00	40.00	65.00
2nd week of January 2020	100.00	100.00	20.00	40.00	65.00
3rd week of January 2020	100.00	100.00	20.00	40.00	65.00
4th week of January 2020	100.00	100.00	20.00	40.00	65.00
1st week of February 2020	100.00	100.00	20.00	40.00	65.00
2nd week of February 2020	100.00	100.00	20.00	40.00	65.00
3rd week of February 2020	100.00	100.00	20.00	40.00	65.00

4th week of February 2020	100.00	100.00	20.00	40.00	65.00
1st week of March 2020	100.00	100.00	20.00	40.00	65.00
2nd week of March 2020	100.00	100.00	20.00	40.00	65.00
3rd week of March 2020	100.00	100.00	20.00	40.00	65.00
4th week of March 2020	100.00	100.00	20.00	40.00	65.00
1st week of April 2020	100.00	100.00	20.00	40.00	65.00
2nd week of April 2020	100.00	100.00	20.00	40.00	65.00
3rd week of April 2020	100.00	100.00	20.00	40.00	65.00
4th week of April 2020	100.00	100.00	20.00	40.00	65.00
1st week of May 2020	100.00	100.00	20.00	40.00	65.00
2nd week of May 2020	100.00	100.00	20.00	40.00	65.00
3rd week of May 2020	100.00	100.00	20.00	40.00	65.00
4th week of May 2020	100.00	100.00	20.00	40.00	65.00
1st week of June 2020	100.00	100.00	20.00	40.00	65.00
2nd week of June 2020	100.00	100.00	20.00	40.00	65.00

Table 3: Population of grubs on grape vines

Date of observation	Number of grubs/cordon/week				
	Orchard 1	Orchard 2	Orchard 3	Orchard 4	Mean
1st week of November 2019	9.84	9.28	9.06	8.00	9.04
2nd week of November 2019	9.92	9.52	9.00	7.00	8.86
3rd week of November 2019	9.64	9.12	9.13	9.52	9.35
4th week of November 2019	9.48	9.12	8.84	9.12	9.14
1st week of December 2019	9.36	9.00	8.76	8.60	8.93
2nd week of December 2019	9.28	9.06	8.80	8.56	8.92
3rd week of December 2019	9.52	9.00	8.68	9.40	9.15
4th week of December 2019	9.12	9.13	8.64	9.28	9.04
1st First week of January 2020	9.12	8.84	8.28	8.00	8.56
2nd week of January 2020	9.00	8.76	8.20	8.12	8.52
3rd week of January 2020	9.12	8.80	8.48	8.24	8.66
4th week of January 2020	10.32	8.68	8.20	8.24	8.86
1st week of February 2020	10.44	8.64	8.24	9.00	9.08
2nd week of February 2020	10.16	8.60	9.00	8.32	9.02
3rd week of February 2020	10.24	8.64	8.56	8.04	8.87
4th week of February 2020	10.04	8.56	8.00	8.16	8.69
1st week of March 2020	10.08	8.00	8.32	7.24	8.41
2nd week of March 2020	10.00	7.00	7.96	7.00	7.99
3rd week of March 2020	10.20	7.00	7.84	7.00	8.01
4th week of March 2020	8.00	6.00	6.2	6.00	6.55
1st week of April 2020	9.00	9.00	8.84	8.16	8.75
2nd week of April 2020	9.12	9.13	8.76	7.00	8.50
3rd week of April 2020	10.32	8.84	8.80	7.00	6.99
4th week of April 2020	10.44	8.56	8.32	6.20	8.38
1st week of May 2020	0.20	0.00	0.16	0.20	0.14
2nd week of May 2020	0.00	0.00	0.00	0.00	0.00
3rd week of May 2020	0.00	0.00	0.00	0.00	0.00
4th week of May 2020	0.00	0.12	0.00	0.00	0.03
1st week of June 2020	0.00	0.00	0.00	0.00	0.00
2nd week of June 2020	0.00	0.00	0.00	0.00	0.00

Table 4: Population of pupae and adults on grape vines

Date of observation	Number of pupae and adults/cordon.				
	Orchard 1	Orchard 2	Orchard 3	Orchard 4	Mean
1st week of November 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
2nd week of November 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
3rd week of November 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
4th week of November 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
1st week of December 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
2nd week of December 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
3rd week of December 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
4th week of December 2019	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
1st First week of January 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
2nd week of January 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
3rd week of January 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
4th week of January 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
1st week of February 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
2nd week of February 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)

3rd week of February 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
4th week of February 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
1st week of March 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
2nd week of March 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
3rd week of March 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
4th week of March 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00
1st week of April 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
2nd week of April 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
3rd week of April 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)
4th week of April 2020	8.00(0.00)	6.00(0.00)	6.40(0.00)	7.20(0.00)	6.90(0.00)
1st week of May 2020	3.00(7.20)	4.16(6.93)	3.32(6.60)	3.00(6.00)	3.37(6.68)
2nd week of May 2020	4.24(5.60)	3.00(5.46)	3.36(5.26)	2.88(5.33)	3.37(5.91)
3rd week of May 2020	4.00(4.86)	3.00(4.93)	3.28(5.06)	2.76 (4.80)	3.26(5.39)
4th week of May 2020	2.80(5.06)	1.88(5.33)	2.84(5.46)	2.72(5.73)	2.56(4.96)
1st week of June 2020	0.00(7.00)	0.00(8.00)	0.00(8.00)	0.00(8.40)	0.00(7.85)
2nd week of June 2020	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)

Figures in the parentheses are number of adults.

3.2. Diagnosis of pest and nature of damage

3.2.1. Diagnosis of pest

Eggs of the *S. barbatum* were observed below the bark, in cracks and crevices of wood, either singly or in groups. They are white, oval resemble rice grains (Fig 1a). Grubs are elongated, cylindrical, creamy white in color with brown head and reduced legs (Fig 1b). Pupae are also creamy white in color and execrate type. (Fig 1c). Newly emerged beetles are yellowish brown in color (Fig 2a). Later turn to black colour at 3-4 days of emergence with the sclerotization of cuticle. Further males (2b) are smaller than females. Antennae in case of females equals to the body length whereas in case of males it is about 1.5 times the body length. (Fig 2c). Size polymorphism is observed both in pupae (Fig .3a) and adults (Fig .3b).

Fig 1c: Pupa of *S. barbatum*

Fig 1a: Eggs of *S. barbatum*

Fig 2a: Adult just after emergence.

Fig 1b: Grub of *S. barbatum*

Fig 2b: Sclerotised male

Fig 2c: Sclerotised female

Fig 3a: Size polymorphism in Pupae

Fig 3b: Size polymorphism in adults

3.2.2. Nature of damage

The grubs immediately after hatching bored into the wood. No external signs of pest infestation were seen immediately after attack by the pest except the gnawing or Kit kat sound made by feeding grub on wood which could be heard on careful observation near the infested vines .In majority of cases, its damage was manifested after a long time infestation due to long larval life which can be seen during fruit bearing period. Grubs formed irregular tunnels and galleries (Fig. 4a and 4b) and tunnels were found clean with grubs and minute granules of excretory pellets only, during the initial stages of infestation. As the infestation continued galleries and tunnels were tightly packed with very fine powdery frass (sawdust-like substance) .Under heavy infestations by feeding grubs tunnels and galleries were interlaced so the interior of the wood was reduced to powder but exterior surfaces were left intact. (Fig 4c, 4d and 4e) Powdery frass created by grub is packed tightly in their galleries, can be seen both in both sapwood and heartwood. Excretory pellets in the form of minute granules were seen only during the early periods of infestation which were later covered by powdery frass. Grubs pupated at the end of their galleries and no discrete pupal cells are observed.

Fig 4a Fig 4b

Fig 4c Fig 4d

Fig 4a: Tunnels of grubs of *S. barbatum* . 4b: Galleries of grubs of *S. barbatum* 4c: Grubs of *S. barbatum* packed in fine powdery frass. 4d: Left over periderm with grub

The adults immediately after emergence were seen within the tunnels or galleries (Fig 5a) before they come out by cutting near circular exit holes (Fig 5b). All the three stages *viz* grubs, pupae and adults were seen covered with or dusted with fine wood flour under severe infestation conditions. (Fig 6a, b and c)

The leaves didn't show any symptoms of chlorosis and wilting and were intact and the orchards were fully green even though they are loaded with grubs. But the grape vines attacked by the pest, particularly the cordons with feeding grubs didn't bear any fruit bunches which is also a typical symptom of damage by the pest *S. barbatum.* (Fig. 7). The cordons harboring grubs were very weak and could be easily broken into pieces with little force. *S. barbatum* caused up to 90 per cent yield loss. The dry conditions of the vines favored the heavy incidence of this pest. Grape vines attacked by *S. barbatum* were also found to harbor termites

Fig 5a: Adult within tunnel

Fig 5b: Exit hole of adults of *S. barbatum*

Fig 6a: Grub covered with wood powder

Fig 6b: Pupa covered with wood powder

Fig 6c: Adult covered with wood powder

Fig 7: Cordons with grubs, green leaves without fruit bunches

The present investigations conducted on the identity of this new pest by keys and DNA bar-coding are in line with the reports of Salini and Yadav (2011) [10] and Jadhav *et al.* (2018) [12] Similarly the nature and symptoms of damage of *S. barbatum* are in agreement with Salini and Yadav (2011) [10] who reported that the grubs made winding tunnels by boring their way inside the wood. The tunnels were tightly packed with fine floury wood dust and excreta, which hampers the translocation of nutrients and in turn seriously reduces the bearing capacity or leading to complete drying of the affected cordons. The gnawing sound could be heard in the plantations where the infestation is severe. Pupation occurred inside the tunnel. The adults came out of the plants by making oval or near rectangular holes. The number of holes in one vine varied from 4-8 or even more than 8 occasionally. Presence of more than one larva was observed in all the examined cases. The pest was also found feeding on live green vines.

Diagnosis of *S. barbatum* on other crops, timber and wood other than grape are reported by few workers which are in agreement with the present investigations. Anonymus (2016) [18] reported that the larvae scraping on the wood makes a characteristic “kit kit” sound which can be easily heard.

Similarly Ahmad and Faisal (2016) [19] studied nature damage by *S. barbatum* on poplar and reported that in majority of cases, its damage is manifested after a long time of its infestation due to long larval life.

The other cerambycid stem borer *C. scabrator* which is a major pest in the grape ecosystem, contrary to this new pest *S. barbatum* produces typical symptoms like, extrusion of frass through the bored hole and chlorosis of leaves once the grub tunnels through the branches and trunk and also oozing of gum. With these visible symptoms one can easily plan for management strategies for *C. scabrator* which is not possible with new pest *S. barbatum* where in the gnawing kit kat sound

produced by feeding grub is the only clue for the grape growers.

S. barbatum has very wide distribution in Asian countries, African countries and islands in the Indian Ocean (Vitali 2015), [20] and capable of developing on more than 350 species of hosts and it is a dry wood species (Duffy 1968). [21] The pest can also attack various wood products including furniture, packaging materials, specimen of museum, bamboo stakes etc. and hence is transported in international trade (Cocquempot *et al*., 2014) [22]

Thus there is every chance that *S. barbatum* becomes serious pest on grape in other parts of the country and grape growing regions of the world.

4. Conclusion

This is the first report of occurrence of *S. barbatum* on grape in Karnataka state which is emerging as a major pest in grape ecosystem. The key for the proper insect pest management is to identify pest correctly, understand its biology and behavior, the kinds of damage and symptoms it produces in a new ecosystem and application of proper integrated pest management in order to achieve a crop production system that optimizes the use of natural resources, protects the environment, and maximizes output in a sustainable way. Hence the present investigations were carried out for correct identification of this new pest on grapevines, an important commercial fruit crop of this region, to understand its nature of damage and the visible symptoms produced by it. Further studies which need immediate attention like its probable routes of entry, bio ecology and management are in progress. Extensive surveys are also needed to find out its status on other host plants which included majority of forest tree species.

5. Acknowledgement

Authors are very much thankful to DR. D.W. Rajasekhar (Joint Director, State Dept of Agriculture, Karnataka State) for providing all the facilities for conducting the present studies and Post graduate students, Dept of Ag. Entomology, College of Agriculture, Vijayapura (UAS, Dharwad) for helping throughout the study period.

6. References

1. Quick dissolving tablets. http://agricoop.nic.in/sites/default/files/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf. 9 July, 2020
2. Anonymous. Infestation of grape varieties by stem borer. Agricultural Research Review Committee report. (Mahatma Phule Krishi Vidyapeeth, Rahuri, India), 2018; 1976:50-51.
3. Mani M, Shivaraju CS, Srinivasa Rao. Pests of grapevine: a worldwide list. Pest Management in Horticultural Ecosystems. 2014; 20(2):170-216.
4. Galet P. Les maladies et les parasites de la vigne.Tome 2. Les parasites animaux. Galet Pierre Eds. 1982, 500.
5. Azam KM. Un coleoptere parasite de la vigne (*Coelosterna scabrata* F.). PAV (Le progress Agricole et Viticole). 1979; 96(21):433-434.
6. Ashihara W. Effects of Temperature and Photoperiod on the Development of the Grape Borer, *Xylotrechus pyrrhoderus* Bates (Coleoptera: Cerambycidae). Japanese Journal of Applied Entomology and Zoology. 1982; 26:15-22.
7. FAO. Global Forest Resources Assessment 2000(FRA 2000), 2001.
8. Jagginavar SB, Sunitha ND, Patil DR. Seasonal incidence, injury and integrated management of *Celosterna scabrator* Fabr (Coleoptera: Cerambycidae) in grape vine ecosystem. Paper presented at International Symposium on grape production and processing, (Baramati, India). 2006, 120-121.
9. Mani M, Kulkarni NS, Adsule PG. Management of stem borer on grape. Extension folder 20. NRC grape. (Pune, India), 2008.
10. Salini S, Yadav DS. Occurrence of *Stromatium barbatum* (Fabr.) Coleoptera: Cerambycidae) on grape vine in Maharashtra. Pest Management in Horticultural Ecosystem. 2011; 17(1):48-50.
11. Kariyanna B, Mohan M, Utpal D, Ravi B, Anusha HA. Important longhorn beetles (Coleoptera: Cerambycidae) of horticultural crops. Journal of Entomology and Zoology Studies. 2017; 5(5):1450-1455.
12. Jadhav RS, Yadav DS, Amala U, Sawant IS, Ghule SB, Bhosal AM. Morphometric Analysis and Deoxyribonucleic Acid Bar coding of New Grapevine Pest, *Stromatium barbatum* (Fabricius) (Coleoptera: Cerambycidae) in India. Proc Natl Acad Sci, India - Section B: Biological Sciences · February 2017. DOI.277 10.1007/s40011-017-0848-x
13. Sunitha ND**,** Khader Khan H, Giraddi RS. Studies on yield loss by grape stem borer *Celosterna scabrator* Fabr. (Cerambycidae: Coleoptera), Journal of Entomology and Zoology Studies. 2017; 5(6):1352-1355.
14. Yadav DS, Ranade YH, Samarth RB. Cytology of stem borer *Stromatium barbatum* (F.) infesting grapevines in Maharashtra, Indian Journal of Entomology. 2019; 81(1):170-176.
15. Goodwin S, Pettit MA. *Acalolepta vastator* (Newman) (Coleoptera: Cerambycidae) infesting grapevines in the Hunter Valley, New South Wales 2. Biology and Ecology. Journal of Australian Entomology Society. 1994; 33:391-397.
16. Goodwin S**.** Chemical control of fig longicorn, *Acalolepta vastator* (Newman) (Coleoptera: Cerambycidae), infesting grapevines. Australian Journal of Entomology. 2005; 44:71-76.
17. Ocete R, Del Tio R. Presencia del perforador *Xylotrechus arvícola* (Olivier) (Coleoptera, Cerambycidae) en vinedos de la Rioja Alta. Bol. San. Veg. Plagas. 1996*;* 22:199-202.
18. Anonymus. Importing timber and timber products – What's inside? Department of Agriculture and Water Resources, Canberra. Australia, 2016, 11.
19. Ahmad M, Faisal M. Status of insect pests of poplar in India with special reference to *Clostera* spp. Forestry Bulletin. 2012; 12(1):105-122.
20. Vitali F. Cerambycoidea.com: The first web-site about the world-wide Cerambycoidea. www.Cerambycoidea.com.2015.
21. Duffy EAJ. A monograph of the immature stages of oriental timber beetles (Cerambycidae). [London: British Museum (Natural History)], 1968.
22. Cocquempot CA, Drumont D, Brosens HV, Ghate. First interception of the cerambycid beetle *Stromatium longicorne* (Newman, 1842) in Belgium and distribution notes on other species of *Stromatium* (Coleoptera: Cerambycidae: Cerambycinae). Bulletin de la Societe royale belge d'Entomologie. 2014; 150:201-206.