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Insect pests of black plum, *Syzygium cumini* (l) skeels from amba reserve forest of Kolhapur district, Maharashtra

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Abstract
The present study reports the insects associated with Black plum, *Syzygium cumini* (L.) Skeels from Amba reserved forest of Kolhapur district. It is a well distributed medicinal plant found in all forested area of the Kolhapur district. The observations on the insect herbivores associated with Black plum revealed that it is infested by 14 species of insects belonging to the 03 orders distributed within 10 families. The survey on the larval breadth diet revealed that Lepidopteran and Coleopteran species were polyphagous in nature. These polyphagous pests are *Metanastria hyrtaca* Cramer, *Trabala vishnu* Lefebvre, *Parsa lepida* Cramer and *Apoderus tranquebaricus* Fabricius. The life cycle of these pests was also studied in the field as well as in the laboratory. The present investigation also provides data on larval food preferences of these pests from present study area.

Keywords: Kolhapur, Western Ghats, insect pests, polyphagus, *Syzygium cumini* (l.) skeels

Introduction
The associations between insect herbivores and tropical forest plants have been widely studies in last three decades. These studies on the phytophagus insect fauna of tropics showed that the tropical forest is rich in species diversity (Barbosa & Schultz, 1987; Price *et al*., 1991; Nair, 2007) [8, 28, 25]. On the other hand, insects associated with natural stands and artificial stands displays different levels of diversity, population fluctuations, % of folivory and diet breadths according to the availability of food plants, host plants and favorable climatic conditions. The diversity of forest insects is also reflected in their feeding habits. Generally every organic material in the natural stands is eaten by one or other insect species. Consumption of a plant material is a subject of great economic importance as well as biological importance (Barbosa & Schultz, 1987; Price *et al*., 1991; Hunter *et al*., 1992; Bernays and Chapman, 1994) [8, 28, 15, 10]. Insects cause damage to plant in every stage of the growth from the seed to the finished products. It ranges from 0% to 100% consumption of plant material (Nair, 2007) [25]. Regupathy *et al*., (1995) [31] has given the common categories of insect damage and their signs associated with forest and shade trees. Our observations on the insect herbivores associated with 50 different forest plants from Kolhapur district revealed that 106 different phytophagous insect species are found associated with them. Among these 53 plants Black plum, *Syzygium cumini* (L.) Skeels attracts and shelters variety of insects in all seasons. It is a very common tropical evergreen tree. It has great medicinal value (Chagas, 2015, Arya *et al*., 2017) [12]. Many eminent entomologists observed this plant for insect pest incidences and their management (Lefroy, 1909; Ayyar, 1940; Beeson, 1941; Mani, 1974; Mathur, 1975, Butani, 1979, Kumar *et al*., Nair, 2000; Nair, 2001; Nair, 2007; 2010) [20, 21, 11, 25]. About 300 species of insects are known to occur on Black plum from Indian subcontinent (Kumar *et al*., 2010). In the present investigation, observations were made on the occurrence of insect pests on *Syzygium cumini* (L.) Skeels from 2018 to 2021 from the Amba Reserve Forest, Taluka Shahuwadi of Kolhapur District.

Material and Method
Study area
Observations on the insects associated with Black Plum were recorded at Amba reserve forest, Taluka Shahuwadi District Kolhapur. The geographical coordinates of Amba reserve forest are 15^0 43' to 17^0 10' north and longitude 73^0 40' to 74^0 42' east and 691.3 meters above Mean Sea Level. It is situated at North-West of Kolhapur district. The vegetation cover is semi evergreen. The geographical area is 318.16 ha. The average annual rainfall noted was 6000 mm. Temperature of this region during summer, winter and Rainy Season ranges from 25 ^{0}C to 38 ^{0}C, 10 ^{0}C -30 ^{0}C and 15 ^{0}C -30 ^{0}C respectively.

Sampling sites and field survey
Following are the sampling sites selected for present study. The site selection is as per the distribution of Black plum in the Amba reserve forest.

Table 1: Observation sites selected for the study

Forest	Amba Reserve Forest
Sampling sites	1. Manoli Dam
	2. Sacred grove
	3. Waghzara
	4. Jambhaliche Pani
Number of sampling sites	04

Sampling Duration, strategies and rearing of insects

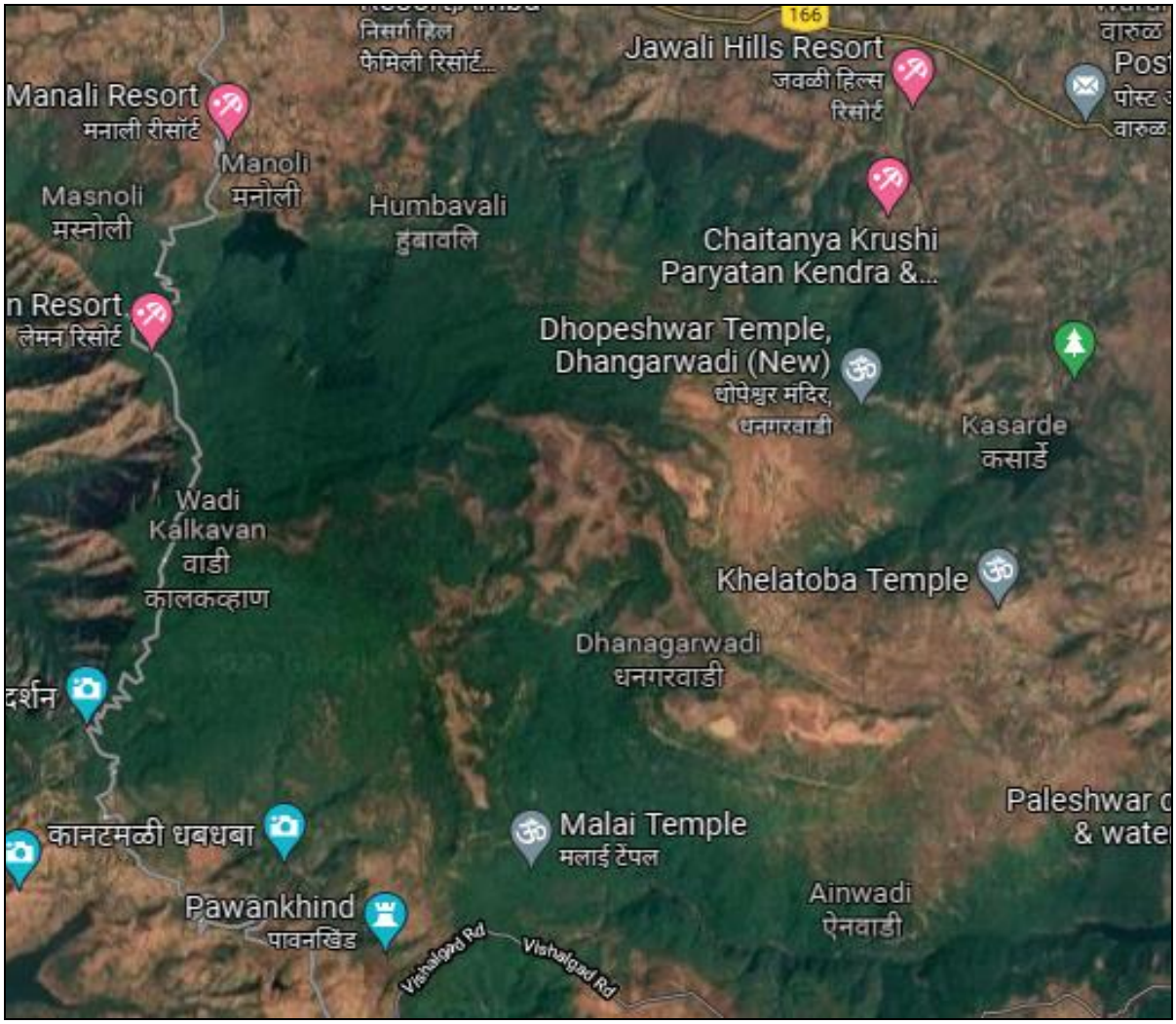
The field surveys were conducted during the years 2018 to 2021. The sampling was carried out at fortnight intervals during all the seasons. However, in monsoon, the period from June to September found to be most suitable for collections, observations and to understand the association of insect herbivores within study sites. Because several insects start their activity or life cycle with the first downpour of monsoon. The sampling and observation method was followed as per Leather, 2005. Life cycle of major insect pests were studied in the laboratory. Regular insect rearing cages are used to rare insects. The optimum humidity and temperature was maintained at laboratory. The food of developmental stages was harvested from the Black plum plants from the field.

Killing, preservation, mounting and labeling

The preservation, mounting and labeling of insect was followed as per Alfred and Ramkrishna (2004).

Identification of species

The identification of insect specimens was made with the help of available literature (Hampson, 1892-1896; Lefroy; 1909; Arrow, 1917; Stebbing, 1914; Sevatsopulo, 1939; Beeson, 1941; Mani, 1974; Mathur, 1975) [49, 5, 34, 20, 21].



Satellite view of study area: Amba Reserve Forest, Tal. Shahuwadi, Kolhapur

Source:https://www.google.com/maps/@16.9187387,73.7978879,11414m/data=!3m1!1e3!5m2!1e2!1e4

Fig 1

Results and Discussion

Insect pests associated with Black Plum, *Syzygium cumini* (L.) Skeels in study area

The survey and collection of insect pests associated with *Syzygium cumini* (L.) Skeels was carried out at all the sites in the study area. Investigation on the insect herbivores yielded 14 species of insects belonging to the 03 orders distributed within 10 families (Table 2). Not only insect show high diversity among all animals, it also reflected in their habitat and feeding habits. Associations of insect pests with specific plant organs were also recorded. They were found on flowers, fruits, foliage, stem and roots. Among these folivorous insects dominated the remaining groups. Kumar *et al*. (2010) reported 300 species of insects associated with Black plum. Black plum was studied in various states of the country for the pest incidences and their management. Raut *et al*. (2021) [30] reported *Meridarchis scyrodes, Carea subtilis, Adoretus spp., Acrocercops spp* as serious pests of Black plum. Among the insect herbivores associated with the Jamun, Fruit borers and leaf feeders cause serious damage the plant (Singh *et al*., 2009) [33]. *Meridarchis scyrodes* is a serious Black Plum fruit borer reported from the States of Gujarat, Maharashtra, Andhra Pradesh, Karnataka and other states of the country. Under severe infestation of this fruit borer, 70% yield loss has been reported (Haldhar and Maheshwari, 2018). In the present study area, *Metanastria hyrtaca, Trabala vishnu, Caerea subtilis* and *Apoderus tranquebaricus* have been recorded as major insect pests. The immature stages of these folivorous insects causes damage to the plant. Leaf gall, *Trioza jambolanae* is also a serious pest in the study area. The larvae of *Parsa lepida* also causes damage to the foliage but is a highly polyphagous insect mostly found on the *Terminalia tomentosa* in the study area. Very few incidences of *Psiloptera orientalis* were recorded in the present study area. Larvae of *Orgyia postica* and *Antheraea mylitta* were also recorded on the leaves of *S. cumini*. The damage caused by chafer beetle *Anomala bengalensis* is noticed in the month of May and June. Incidence of bark eating caterpillar *Inderbella* spp is also recorded from the study area on the Black plum.

Table 2: Insect herbivores associated with Black Plum, *Syzygium cumini* (L.) Skeels from Amba Reserve Forest, Shahuwadi, Kolhapur

Sr. No	Scientific Name	Order	Family	Primary food plant	Affected plant parts and damaging stage	Other food plants
1	*Trioza jambolanae* Crawford	Hemiptera	Psyllidae	*Syzygium cumini*	Leaf: Nymph	Not recorded
2	*Orgyia postica* Walker	Lepidoptera	Lymantridae	*Syzygium cumini*	Leaf: Larva	Not recorded
3	*Parasa lepida* Cramer	Lepidoptera	Limacodidae	*Syzygium cumini.*	Leaf: Larva	*Careya arborea, Butea monosperma, Bridelia retusa, Sapium insegne, Acacia auriculiformis, Terminalia arjuna, Terminalia tomentosa, Mangifera indica,*
4	*Metanastria hyrtaca* Cramer	Lepidoptera	Lasiocampidae	*Syzygium cumini,*	Leaf: Larva	*Bridelia retusa, Terminalia tomentosa, Terminalia arjuna*
5	*Trabala vishnu* Lefebvre	Lepidoptera	Lasiocampidae	*Syzygium cumini,*	Leaf: Larva	*Terminalia arjuna, Terminalia tomentosa, Butea monosperma, Eucalyptus globulus, Lagerstroemia sp.*
6	*Carea angulata* Fab.	Lepiodoptera	Noctuidae	*Syzygium cumini*	Leaf: Larva	Not recorded
7	*Antheraea mylitta* Drury	Lepidopterqa	Saturniidae	*Syzygium cumini,*	Leaf: Larva	*Terminalia tomentosa, Terminalia arjuna*
8	*Inderbela* sp	Lepidoptera	Inderbelidae	*Syzygium cumini,*	Bark: Larva	*Eucalyptus, Terminalia tomentosa, Terminalia arjuna*
9	*Noctuides sp.*	Lepidoptera	Noctuidae	*Syzygium cumini*	Leaf: Larva	Not recorded
10	*Psiloptera orientalis* Fab.	Coleoptera	Buprestidae	*Syzygium cumini,*	Bark: Larva	Not recorded
11	*Holotrichia fissa* Brenske	Coleoptera	Scarabaeidae	*Syzygium cumini*	Leaf: Adult	*Emblica officinalis, Bridelia retusa, Careya arborea, Zizyphus jujuba, Butea monosperma, Grewia sp., Terminalia tometosa, Terminalia arjuna,*
12	*Holotrichia*	Coleoptera	Scarabaeidae	*Syzygium*	Leaf: Adult	*Bridelia retusa, Acacia*

	karschi Brenske			*cumini*,		*auriculiformis, Terminalia T. arjuna, T. Tomentosa*
13	*Anomala bengalensis* Blanchard	Coleoptera	Scarabaeidae	*Syzygium cumini*,	Leaf: Adult	*Cassia fistula*
14	*Apoderus tranquebaricus* Fab.	Coleoptera	Curculionidae	*Syzygium cumini*,	Leaf: Larva and adult	*Terminalia tomentosa, Terminalia arjuna, Mangifera indica, Dimocarpus longan, Mammea suriga, Lagerstroemia, Aporosa lindleyana, Anacardium occidentale, Grewia sp.*

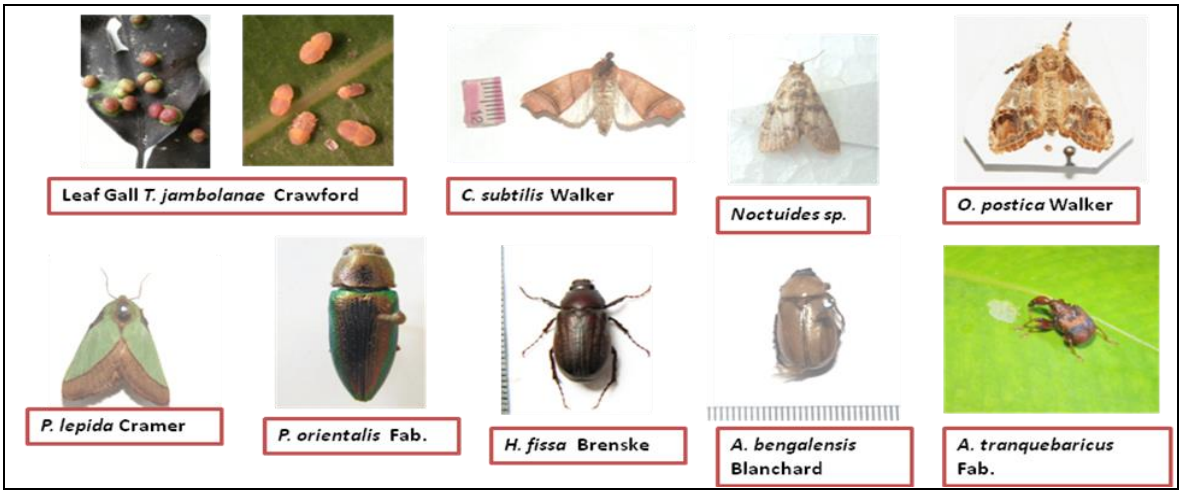


Fig 1: insect herbivores associated with black plum, yzygium cumini (L.) Skeels from amba reserve forest, shahuwadi, kolhapur

Life cycle studies of polyphagous insect pests of *Syzygium cumini* (L.) Skeels

Life cycles of major polyphagous pests were observed in the field and studied under laboratory conditions. The duration required for the completion of life cycle insect pests associated with Black plum is given in table 3.

Among fourteen insect pests recorded on Black Plum, four species are abundantly found on the foliage of the plant. The major pests observed during the study are *Metanastria hyrtaca* Cramer, *Trabala vishnu* Lefebure, Carea subtilis Walker and *Apoderus tranquebaricus* Fabricius. These insects and their developing stages use different parts of *Syzygium cumini* as shelter and food.

Metanastria hyrtaca is a polyphagous pest feeds on *Moringa oleifera, Anacardium occidentale, Acacia nilotica, Acacia catechue.* On *Syzigium cumini*, it takes one and half month for the completion of its life cycle (Premchand, 1995) [27]. Ananthkrishnan (1995) has described the host plants and parasitoids of *Metanastria hyrtaca* and reported that it feeds on the *Tamarindus indica* and *Acacia nilotica.*

It is a polyphagous pest, its larvae feed on foliage of wide varierty of plants. From the earlier studies, it is evident that, there is difference in the duration required for completion of life cycle on different plant species (Nair *et al*., 1974; Premchand, 1995; Aherkar *et al*, 1996; Ambethgar, 2001) [23, 7, 3].

Table 3: Duration of developmental stages of polyphagous insect pests of *Syzygium cumini* (L.) Skeels

Sr. No.	*Stages*	*Trabala Vishnou* Lefebvre	*Metanastriya Hyrtaca* Cramer	*Carea Subtilis* Walker	*Apoderus tranquebaricus* Fabricius
1	Egg	6	7	-	3
2	I- Instar	7	5	3	4
3	II- Instar	8	7	7	6
4	III-Instar	10	8	8	8
5	IV-Instar	11	8	8	-
6	V-Instar	10	10	10	-
7	VI- Instar	9	11	-	-
8	VII Instar	8	10	-	-
8	Pupa	10	8	8	8
9	Adult	6	4	4	9

The life cycle of *Trabala vishnou* was studied in the laboratory as well as in the field conditions. As like *Metanastria hyrtaca* its larvae consume the leaves of *Syzigium cumini* and in cases of severe infestations it may defoliate the trees. The IV and V instar larvae are voracious feeders. Instead of *Syzigium cumini*, it is also recorded on *Shorea robusta* (Premchand, 1995) [7]. *Trabala vishnu* is one of the common Lasiocampid pest. It is recorded on 32 different plant species which belongs to 16 different families of plants (Cheng *et al*., 2002) [13]. Ansari *et al*. (2016) [4] studied the life cycle of *Trabala vishnu* on Castor and provided the detailed account of morphology and duration required for the completion of life cycle. Sevastopulo (1939) [32] described larval morphology of *Trabala vishnu.* Likewise the life cycles of *Carea subtilis,* leaf webbing caterpillar, *Apoderus tranquebaricus* were also studied. The last instar larva of purple winged moth (*Carea subtilis*) has curious voluntary dialation of the first thorasic segment which gives it a quaint appearance. It pupates under the bark in a white silken cocoon (Lefroy, 1909) [19]

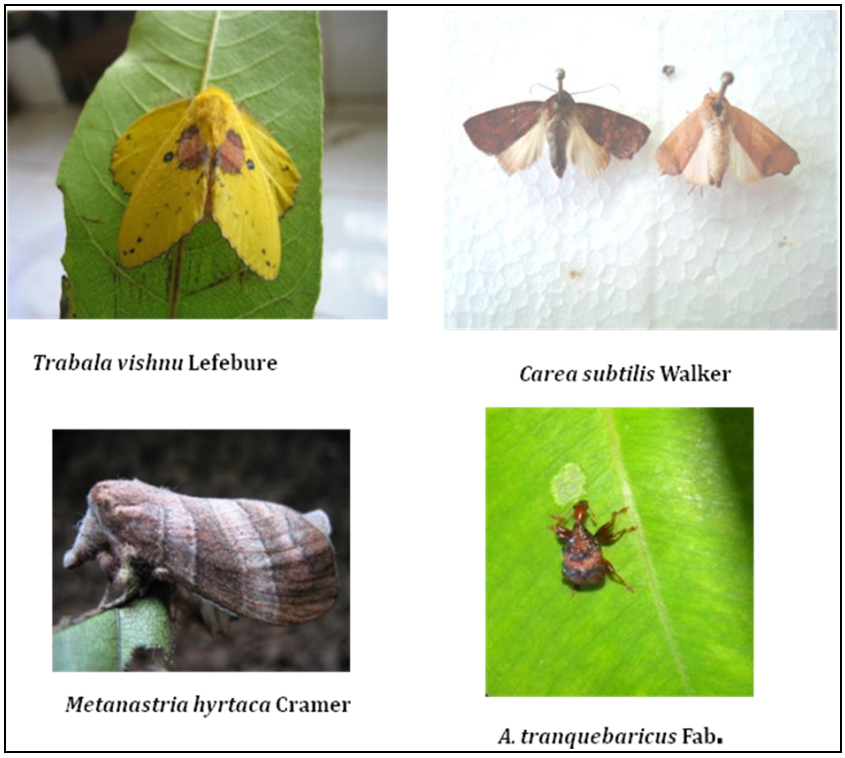


Fig 2: polyphagous insect pests of *Syzygium cumini* (L.) skeels

During the survey and collection of insect pests, the developing stages of *Apoderus tranquebaricus* were collected for the life cycle study. It belongs to the family Attelabidae. Uchara and Suzuki (1998) [35] have studied the host Plants of Subfamily Apoderinae and Attelabinae from the central part of the Japan. The beetles of this family arer mostly polyphagous in nature. The nidus formation and leaf cutting pattern is unique feature of this beetle. Jha and Sen-Sarma described *A. tranquebaricus* as a pest of *Terminalia tomentosa.* In south India it is treated as a pest of *Mangifera indiaca*, (Ayyar, 1940) [7]. De Nicewell fed the larva of *A. tranquebaricus* on *Terminalia catappa*. It also prefers *Anacardium occidentale* as a host plant.

It is a medium sized red brown coloured weevil. After the mating the adults prepare the leaf cases and lay the eggs inside the leaf cases, after hatcing the remains inside the cylindrical masses and feeds on the inner surfaces of the leaf cases. In the study region it was observed that *A. tranquebaricus* feeds on foliage of *Syzigium cumini, Terminalia tomentosa and Terminalia arjuna.* Of these species of pests, no single species cause severe loss but the total damage caused by various insect pests is substantial and warrants the control measures of these pests.

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