

Full Length Research Paper

Pests of Vanilla (*Vanilla planifolia* Andrews) and their natural enemies in Tamil Nadu, India

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Investigations were made from April 2004 to March 2005 in Coimbatore and Theni districts of Tamil Nadu to record the pest status of vanilla and their natural enemies. A total of seven arthropods, seven gastropods and two invertebrates were recorded as pests of vanilla. Out of 60 farms surveyed, only nine had the incidence of pest attack. Among the pests, white grubs and Giant African Snail were found to cause considerable damage to the vanilla plants, while others were not at economic levels. Among the natural enemies, parasitoids like *Euplectrus* sp., *Glyptapanteles* sp., *Aprostocetus* sp., *Chelonus* sp., and Uropoda mites were found to be associated with the pests of vanilla.

Key words: Vanilla, pests, gastropods, natural enemies.

INTRODUCTION

Vanilla, *Vanilla planifolia* Andrews (syn *V. fragrans*) (Salisb.) is the only edible spicy orchid traded in the global market. Though this spice was introduced to India as early as 1835, its commercial cultivation is now restricted to parts of Tamil Nadu, Kerala, Karnataka, North eastern states, Andaman and Nicobar islands. The total area under vanilla cultivation in the world during 2008 was 82,098 ha (FAO, 2009). India's production of vanilla was about 101 Metric Tonnes from about 27811 ha in 2004 to 2005 (MOIB, 2009), but in recent years the area is declining drastically due to low market price and diseases of vanilla. In India, vanilla is predominantly grown by small and marginal growers in their fields interplanting with other crops. There are several factors acting upon, reducing the quantity as well as the quality of vanilla. Vanilla, 'the orchid of commerce', though it has been introduced a decade ago in Tamil Nadu, there is no report on the incidence of pests still now. Hence, the present investigation was taken up in order to investigate the status of pests of vanilla in and around major vanilla growing areas of Tamil Nadu namely, Coimbatore and Theni districts.

MATERIALS AND METHODS

The farmers' vanilleries at Coimbatore and Theni Districts of Tamil Nadu were surveyed for the pests. A total of 60 vanilla farms were surveyed during the twelve months period from April, 2004 to March, 2005 and a total of hundred plants in each farm were observed. In every field, a plant was selected at random from one end of the field and then every tenth plant was observed along the row until 100 plants were completed. For the subterranean pests, mulch at the base of the plant was removed with utmost care up to 30 cm radius and 15 cm depth, and the number of insects present and extent of root and underground shoot damage (coiled shoot) were noted.

For the gastropod pests (snails and slugs), the population density was recorded by quadrat method as adopted by Craze and Mauremootoo (2002). An area of 5 × 5 m² was marked randomly in five places in the farmers' field and examined for the presence of the snails and slugs. The observations were made at the plant base, mulches, above ground plant parts, the supporting plants (*viz.*, gliricidia, jatropha and arecanut) as well as on the intercrops (*viz.*, coconut, arecanut, cacao, nutmeg and pepper) within the selected plots. The population of gastropods as well as the extent of feeding damage was recorded.

During the survey, the natural enemies of pests of vanilla were also recorded. Field collected larvae of shoot and leaf webber, semilooper and hairy caterpillars were kept in separate cages under laboratory and observed for the emergence of any natural enemies. The pests collected from the vanilleries and the natural enemies were identified by taxonomists at TNAU, Coimbatore (Tamil Nadu), Calicut (Kerala), Udipi (Karnataka) and IARI, New Delhi.

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RESULTS AND DISCUSSION

Pests

Out of 40 vanilla farms surveyed, the incidence of the pests was noticed only in nine farms. Both insect and non-insect pests were known to damage vanilla crop with varied capacities. Seven arthropods (including coleopteran, lepidopteran and hemipteran insects), seven gastropod species and two vertebrates were found to be associated with vanilla during the study period (Tables 1, 2 and 3). Among the pests recorded in Tamil Nadu, a few were reported for the first time while some pests were reported formerly by Varadarasan et al. (2002) in Kerala, India. Pests were found consuming almost every part of the vanilla plant including the leaf, shoot tip, vine, root, flower and bean. Apart from direct injury, they predisposed the plants to sun scorch and several pathogens *esp.* Phytophthora fungi and bacteria. Though most of the pests were of minor importance, white grubs and Giant African Snail were more severe causing huge loss in some of the vanillaries.

Two species of white grubs were recorded, in which, *Holotrichia rufiflava* Brenske was recorded for the first time in vanilla all over the world, however, *H. serrata* was the predominant one. Grubs of second and third instars consumed the vanilla roots as well as the coiled stem found underneath the soil. Voracious feeding by the grubs resulted in death of even well established mature plants. Under severe infestation, the root system was completely lost and the stem was cut at the site of feeding. As a result, the plants started developing dull ashy green leaves followed by yellowing, drooping and drying of leaves and at last the plants completely dried and died after 10 to 15 days of severe feeding.

Besides, vanilla bug (*Halyomorpha* sp. nr. *picus* Fab.) and the shoot and inflorescence webber (*Archips micaceana* Walker) were capable of causing intense damage to the vines. Both nymphs and adults of the bug sucked the sap from tender plant parts of vine *viz.*, shoot tips, tender leaves and inflorescence initials. Pin-prick like punctures were formed due to depletion of the sap and at later stage necrosis and rotting were noticed. The affected shoot tips and inflorescence initials were rotten and dropped off within 3 to 5 days. Prakash and Sudharshan (2002) have recorded losses of up to 40% only by vanilla bug in some parts of Kerala.

The larvae of the shoot and inflorescence webber were noticed mostly within the unopened shoot bud or in between the bud and the first leaf and sometimes in between stem and the second leaf. The larva often formed webs and fed within by scrapping the epidermis of the leaves, which turned brown and appeared scabby. The damaged leaves later became crinkled and malformed. The growth of the tender plants was affected due to severe feeding and as a result, plants became stunted. At later stages, the larvae scrapped deeper

towards inside, damaging the epidermis of the growing stem. Though the plant grew further, the plant broke at the feeding site since the damaged stem portion was thinner compared to the region above.

The occurrence of hairy caterpillars *viz.*, *Euproctis scintillans* Walker, *E. bigutta* and *Pericallia ricini* Fabricius and semilooper *Plusia* sp. were found only on very few farms at a lower population levels. *E. scintillans* and *E. bigutta* were recorded for the first time as pests of vanilla. These caterpillars defoliated the tender leaves and the growing shoot tip both in the nursery as well as the main field. Tettigonid, *Phaneroptera gracilis* Burmeister was also reported for the first time on vanilla whose damage was due to ovipositional punctures in the lower stem region covered with mud. The affected tissues turned brown and found rotten. The infestation was found to spread from the lower region to the upper stem regions at the later period resulting in weakening of the plant. The incidence was most severe during July to August and January to March, though found throughout the year.

Apart from insects, seven species of molluscs were also found to be associated with vanilla in different vanillaries (Table 2). The estimated number of species of molluscs today varied from 80,000 to 135,000 species (Abbott, 1989). Most of the molluscan species were recorded for the first time in vanilla. Among the molluscan species, the giant African snail, *Achatina fulica* Bowdich 1822 and the slug, *Vaginulus* sp. were the most voracious feeders. The feeding damage was observed in about 45% of the vanilla plants at Valandayamaram and 34% at Kotur. Gastropods consumed the stem, leaves, beans and roots of plants making them amenable to sun scorch and to pathogenic attack. The main target of attack was the epidermis of the stem followed by the leaves, flowers and beans. Due to severe feeding by the giant African snail, the plant often cut off from the root and dried out at intense feeding sites. All the species of molluscs were observed to defoliate the plants and the slugs besides defoliation, fed on the vanilla roots. Mevinkurve et al. (2004) also reported that the slugs of the genus *Mariaella* as serious pests of the commercial vanilla crop and they found those slugs were endemic to the Western Ghat/ Srilanka ranges.

In addition, wild boars and elephants often visited the vanillaries because most of the vanillaries were located at the foothills of mountains and forest areas. Elephants damaged the crops by trampling, whereas, the wild boars damaged plants by digging through the soil thus disturbing the more sensitive roots.

Vanilla plants were comparatively free of pests during the stress period (November to January) but higher incidence was seen during the flowering period. During the survey, it was noted that the pests occurring on the supporting plant of vanilla, e. g., gliricidia which further reduced the vigour of vanilla plants. For example, high population of the aphid, *Aphis craccivora* on gliricidia in Cumbum area led to stunted. At later

Table 1. Insect and non insect pests of vanilla recorded in Tamil Nadu.

Common name	Scientific name	Family	Stage affecting crop	Plant part (s) affected	Severity of incidence	Location
Coleopteran pest						
White grub	<i>Holotrichia serrata</i> Fabricius	Melolonthidae	Grub- all instars	Roots and underground stem	High	Naraseepuram, Saralaipathy, Odayakulam.
	<i>H. rufoflava</i> Brenske	Melolonthidae	- do-	-do-	High	Naraseepuram.
Lepidopteran pest						
Hairy caterpillar	<i>E. scintillans</i> Walker <i>Euproctis bigutta</i> Genuso <i>Pericallia ricin</i> Fabricius	Lymantriidae	Larva	Shoots and tender leaves	Medium	Saralaipathy, Naraseepuram
Semi looper	<i>Plusia</i> sp.	Noctuidae	Larva	Shoots and tender leaves	Medium	Saralaipathy, Naraseepuram.
Shoot and inflorescence webber	<i>A. micaceana</i> Walker	Tortricidae	Larva	Shoot tips and inflorescence initials	Medium	Naraseepuram, Cumbam.
Hemipteran pest						
Vanilla bug	<i>Halyomorpha</i> sp. nr. <i>picus</i> Fabricius	Pentatomidae	Nymphs and adults	Shoot tips and inflorescence initials	Medium	Naraseepuram.
Tea mosquito bug	<i>Helopeltis</i> sp.	Miridae	Nymphs and adults	Shoots, leaves and beans	Medium	Cumbam- Hilly tracts.
Orthopteran pest						
Long horned grasshopper	<i>P. gracilis</i> Burmeister	Tettigoniidae	Adults	Basal stem and aerial roots	Low	Naraseepuram.
Vertebrates (Mammalia)						
Wild boar	<i>Sus scrofa cristatus</i> Wagner	Suidae,	Young, Adults	Roots	Very low-occasional	Naraseepuram, Kotur, Aliyar.
Elephant	<i>Elephas maximus</i> Blainville	Elephantidae	Young, adults	Whole plant	Very low-occasional	Kotur.
Minor pests						
Red ant	<i>Oecophylla smaragdina</i> F.	Formicidae, (Hymenoptera)	All stages	Leaves and inflorescence initials	Occasional	Naraseepuram, Kotur.

Table 1. Cont.

Grey weevil	<i>Hypotactus ruralis</i> Faust	Curculionidae (Coleoptera)	Adult	Leaves	Occasional	Naraseepuram.
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Pests recorded on *Gliricidia*: *Aphis craccivora*, *Ferrisia virgata*, *Maconellicoccus hirsutus*, *Stenias grisator*, *Hypotactus ruralis*, *Oecophylla smaragdina*, *Oxya nitidula* and termites.

Other crops nearby: Naraseepuram: Coconut, arecanut, mangium, palas, ailanthus, neem, sorghum, sugarcane, paddy; Valandayamaram: Coconut, neem, banana, citrus, anona; Saralaipathy: Coconut, breadfruit, arecanut, jamoon, banyan tree; Odayakulam: Coconut, arecanut, pepper, sambak, cocoa, nutmeg, cinnamon; Aliyar: Coconut, arecanut, pepper; Kotur: Coconut, neem, teak, mango, banana, jamoon, cocoa, nutmeg, cinnamon; Sethumadai: Coconut, pepper, nutmeg; Meenakshipuram: Coconut, arecanut, pepper, nutmeg, banana; Cumbam: Coconut, arecanut, grapes, cardamom, tea, cashew, nutmeg.

Table 2. Molluscan species recorded in different vanillaries.

Molluscan species	Taxonomy: Mollusca, Gastropoda, Stylommatophora.	Month of observation	Location
	Family		
Snails			
<i>A. fulica</i> Bowdich	Achatinidae	September January	Valandayamaram, Kotur
<i>Macrochlamys</i> sp.	Ariophantidae	October	Naraseepuram
<i>Cryptozona</i> sp.	Ariophantidae	August	Saralaipathy, Odayakulam.
<i>Euplecta</i> sp.	Ariophantidae	August	Cumbam
<i>Kaliella barrakporensis</i> Grey	Euconulidae	September	Meenakshipuram, Aliyar
Unidentified sp.	Ariophantidae	October	Sethumadai
Slugs			
<i>Vaginilus alte</i>	Veronicellidae	September	Vettaikaran pudur,
<i>Vaginulus</i> sp.	Veronicellidae	September	Naraseepuram and most vanillaries
<i>Mariaella</i> sp.	Ariophantidae	September	Naraseepuram, Valandayamaram

stages, the larvae scrapped deeper development of sooty mould (*Capnodium* sp.) on vanilla vines resulted in their reduced photosynthetic efficiency. Higher incidence of sooty mould infestation (13.24%) was found in Cumbam- Guddalore vanillaries. In addition, attack by *gliricidia* stem borer reduced the supporting value of *gliricidia* plant. Vanilla plants plants. Vanilla plants were comparatively free of pests during the stress

period (November to December) but higher incidence was seen during the flowering period. Similarly, red ants though found on *gliricidia* at times formed nests on the found on *gliricidia* at times formed nests on the leaves (2% at Naraseepuram and 3% at Cumbam area) and inflorescence (7% at Cumbam area) of vanilla. The affected leaves dried out later. The ants also fed on the earthworms found in the mulch of

vanilla. Infestation of the red ants was found to greatly reduce the labour efficiency in vanilla.

Natural enemies

The third instar grubs of *H. serrata* were found to be associated with Uropodid mites (tortoise mites) belonging to the family, Uropodidae. Though

Table 3. Natural enemies of the pests of vanilla.

Pest	Parasitoid/ parasite	Family and order	Intensity	Nature of parasitoid	Period	Location
<i>E. scintillans</i>	<i>Glyptapanteles</i> sp.	Braconidae (Hymenoptera)	17/larva	Larval parasitoid	September	Naraseepuram
<i>Plusia</i> sp.	<i>Euplectrus</i> sp.	Eulophidae (Hymenoptera)	10/larva	Larval parasitoid	September	Naraseepuram
<i>A. micaceana</i>	<i>Chelonus</i> sp.	Braconidae (Hymenoptera)	1/larva	Larval parasitoid	September	Naraseepuram
Tettigonid	<i>Aprostocetus</i> sp.	Eulophidae (Hymenoptera)	3-6 parasitoids / 9-14 plugs.\	Egg parasitoid	Throughout study period	the Naraseepuram
<i>H. serrata</i>	Uropoda mites	Uropodidae (Acari)	6-13 / grub	Phoretic or presumably parasitic	August-September	Naraseepuram

Table 4. Plates of major vanilla pests.

<i>A. fulica</i>	<i>Macrochlamys</i> sp.	<i>K. barrakporensis</i>
<i>E. scintillans</i>	<i>Halyomorpha</i> sp. nr. <i>picus</i>	<i>A. micaceana</i>
<i>Plusia</i> sp.	<i>H. serrata</i>	<i>P. gracilis</i> (damage)

found all over the grub's body, the mites were predominantly observed at the coxal joints, mouth parts, neck and around spiracles of the grub. The mite associated grubs were found restless which may be due to irritant or parasitic nature of the mites. However, the grubs pupated normally and developed into adults. Besides, parasitoids like *Euplectrus* sp., *Glyptapanteles* sp., *Aprostocetus* sp., *Chelonus* s., of Braconidae and Eulopidae were found to parasitize the larvae of hairy caterpillars, shoot and inflorescence webber, semiloppers and the eggs of tettigonids (Table 4).

SUMMARY

Vanilla is prone to attack by several insects and non-insect pests. The pests like the white grubs and common hairy caterpillars occurring on other crops also tend to damage vanilla. Therefore in due course, there are chances of enhanced pest

status in vanilla. This emphasizes the need for development of suitable monitoring and management techniques to ensure a good crop.

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REFERENCES

- Abbott RT (1989). Compendium of lands shell. Melbourne, Australia : American Malacologist.p. 420.
- Craze PG, Mauremootoo JR (2002). A test of methods for estimating population size of the invasive land snail *Achatina fulica* in dense vegetation. J. Chem. Ecol., 39: 653-660.
- FAO (2009). Agriculture production databases. Food and

Agricultural Organisation. Available at: <http://www.apps.fao.org/fao.stat>. Accessed: 13 February 2010.

Mevinkurve GR, Shanbhag SP, Madhyastha NA (2004). Non-marine mollusks of Western Ghats: a status review. Zoos' print journal, 19(12): 1708-1711.

MOIB (2009). India 2009. A reference annual, A compilation of research, reference and training division. Dayawanti Srivastava (Eds.) Published by Publications division. Ministry of information and Broadcasting, Government of India. p. 887.

Prakash KV, Sudharshan MR (2002). Vanilla bug *Halyomorpha* sp. nr. *picus* (Fabricius) (Hemiptera: Pentatomidae) - New pests of vanilla (*Vanilla planifolia* Andrews). Plantation Crops Research and Development in the New Millenium. Indian Cardamom Research Institute. Regional station. Sakleshpur. pp. 493-496.

Varadarasan S, Chandrasekar SS., Ansar AMA, Prakash KV (2002). Status of vanilla pests, In: National consultative meeting for accelerated production and export of spices (Ed. Tamil SM). Published by Directorate of Arecanut and Spices Development, Calicut, Kerala. pp. 83-87.