Pests of ginger and turmeric and their control*

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INTRODUCTION

GINGER and turmeric are important spices valued for their culinary uses and export earnings. The production figures for these crops in 1976-77 in India, being the largest producer, are 43,550 and 1,21,000 tons (dy) from an area of 26,830 and 67,500 hectares respectively (Anonymous 1977 A) which are much below potential. The crop losses due to the pests are not evaluated. However, it is clear empirically that the shoot borer takes a heavy toll of ginger and turmeric in the field. The other important pests are, the rhizome scale, leaf roller, rhizome rot flies, leaf eating beetles etc. It is, therefore, imperative to study the pests fully and suppress them in realising better yields.

The shoot borer, *Dichocrocis punctiferalis* Guenee was observed as the most destructive pest of these crops (Ayyar 1940; Kannan and Nair, 1965). The other pests recorded by Ayyar (1940) were the leaf roller, *Udaspes folus* Cram., the ginger maggot, *Calobata* sp. (Micropezidae), scale insect *Aspidiotus hartii* Green, a reddish brown thrips *Panchaetothrips indica* Bagnall and the lace wing bug *Stephanitis typica* Distant. Memoirs of the Department of Agriculture, Madras (Anonymous 1940) listed important insects affecting cultivated plants in South India including the pests of ginger and turmeric. Mamet (1940) recorded a new species of coccid, *Aspidiotus subterraneus* Mamet on rhizomes of ginger from Mauritius. Sengupta and Behura (1955) recorded three new species of criocerine beetles namely *Lema praeusta* Fabr. L. *signatipennis* jac. and *L. semiregularis* Jac. from Orissa and found that the former two species cause considerable damage to turmeric leaves. Srivastava (1959) observed *stegobium paniceum* L. breeding on the stored rhizome of turmeric in Rajasthan during the rainy season. Reddy (1968), while describing the pests of turmeric, mentioned the Bihar hairy caterpillar *Diacrisia obliqua* Walker among the pests of these crops listed earlier. Katyal (1974) reported *Lasioderma serricorne* F. and the coffee bean weevil *Araecerus fasciculatus* Degeer (Anthribioae) as pests of ginger in storage. Nair (1975) added a few more insects to the list of pests of ginger, which being *Acrocercops. irradians* Meyr. (Lepidoptera: Tineidae) infesting it in Maharashtra; *Chalcidomvia atricornis* Mall. *Formosina Flavipes* Mall (Diptera: Chloropidae) seen in South India feeding inside rhizomes which rot as a result, *Celphus* sp. (Diptera: Celphidae) feeding on the rhizomes in Uttar Pradesh and *Hedychrous rufofasiatus* M. (Coleoptera: Curculionidae) feeding on the leaves. Dubey *et al.* (1977) recorded *Colasposoma splendidum* F. (Coleoptera: Eumolpinae), *Pseudocophora* sp. (Coleoptera: Galerucinae) *Lema lacordairei* Baly, *Epilachna sparsa* Hbst. (Cocoinellidae), *Myllacerus viridanus* F. (Curculionidae) and the dipteran flies *Mimegralla* sp. nr. *coeruleifrons* Macg. (Micropezidae) and *Eumerus* sp. damaging these crops. The nature of damage, life history, control measures etc. of key pests in that order are discussed in the following paragraphs on the basis of available literature.

The shoot borer: Dichocrocis punctiferalis Guenee (Lepidoptera: Pyralidae)

Lefroy (1906) recorded this insect as a pest boring into the castor capsules and destroying them. He further listed other host plants such as sunflower-heads, cacao pods (in Sri Lanka) and Kaikar fruits (*Garuga pinnata*). Fletcher (1914) described the full grown caterpillar as rather stout, pale or reddish brown with numerous flattened horny warts from which arise short bristly hairs with a red brown head and a large prothoracic shield. He recorded it on the stem and seed capsules of castor, pseudostems of curmeric, pseudostems and rhizome of ginger, fruits of guava, mango flowers, sorghum heads, peaches, cacao pods and cardamom capsules. Ayyar (1940) recorded that *D. punctiferalis* caterpillars bore into the central shoots of ginger and turmeric and kill them causing "dead hearts" on the affected plants. Mohan Singh (1941) recorded it on holyhock in autum. In Queensland it was found infesting the pods and stems of soyabeans (Anonymous, 1943). Sloan (1945) reported *D. punctiferalis* from Queensland as most injurious to grain sorghum which cover the head with webbing and excreta. Ansari (1946) reported that winter and summer crops of guava were seriously damaged by this pest. Puttarudriah and Channabasavanna (1951) recorded it in Mysore (Karnataka) on tamarind fruits, mango flowers, pomegranate fruits, cardamon stems and *Andropogon sorghum* Brot. The earheads of sorghum were reduced to powdery mass and the caterpillars were observed breeding on stored sorghum also. The other alternate

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hosts as tabulated from records by David *et al.* (1964) were mulbery, *Cesalpinia bonducella* (Fletcher 1922) loquat (Hussian 1924), Jack fruit, inflorescence of avocado, pear (Anonymous 1952), amaranthus, fruits of *Anona cherimolia* (Anonymous 1960) and soapnut plants (*Sapindus emarginatus*) (David *et al.* 1964) Srivastava (1971) observed it damaging mango panicles and fruits. Narayanan (1959) while admitting *D. punctiferalis* to be an important pest of castor stated that its biology and bionomics have not been studied.

David *et al.* (1964) studied the bionomics of this pest in detail on castor and reported that the eggs are pink, oval and laid singly or in groups of two or three. They described the caterpillar, pupal, and adult stages, nature of damage, seasonal history etc. The total life cycle was completed in 25 to 33 days and found to damage the crop severely from November to March. Patel and Gangrade (1971) studied its life history on castor and noted the total life cycle from egg to adult ranging from 30 to 36 days at room temperature, 48 to 51 days at 20°C, 33 days at 25°C and 27 days at 30°C. Nambiar et al. (1976) reported it as a serious pest of cardamom attacking the nursery plants, young pseudostem of grown up plants and succudent capsules. Extrusion of frass through the bore hole is a characteristic indication of shoot borer infestation. They reported other zingiberaceous hosts like *C. aromatica, C. amada, Alpinia sp. Amomum* sp. and *Aframomum melegueta.*

As a control measure, Lefroy (1906) and Fletcher (1914) suggested removal of affected shoots and capsules of castor. David *et al.* (1964) found that malathion 0.1% parathion 0.05% spray followed by D.D.T. 10% dust or 0.1% spray application at fortnightly intervals effected lower percentage of infestation and increased yield. Kannan and Nair (1965) reported that the pest can be controlled by removing affected shoots and spraying with 0.05% endrin. Sulochana Bai *et al.* (1968) tried to control castor shoot and capsule borer with a number of insecticides and concluded that application of three rounds of parathion 0.05% at 21 days interval commencing at the time of formation of inflorescence may be recommended for obtaining appreciable control of the pest and for realising economically higher yields of beans. The other insecticides like fenthion 0.1%, Imidan 0.1%, malathion 0.05% respectively can be preferred for the control of the pest. Singhvi *et al.* (1971) found field-collected larvae of *D. Punctiferalis,* fed with partly dried castor capsules dipped for 10 seconds in insecticides at different concentrations, died after 24 hrs. with DDT at 0.05%, parathion 0.05%, and dichlorvos 0.05%. Nambiar *et al* (1976) suggested spraying dimethoate or phosphamidon 0.05% or soil application of phorate granules for controlling infestation efficiently on cardamom. Pillai and Abraham (1974) found mephospholon 5% granules @ 9 gms/3 M2 beds (1.5kg a.i./h.a.) reduced shoot borer incidence in turmeric significantly. Rodrigo (1942) recorded three natural enemies of the pest in Ceylon, namely the braconid *Phanerotoma hondecasiella* Cam; the ichneumonid *Xanthopimpla* sp. and *Dolichurus* sp. but none was in appreciable numbers. David et al. (1964) listed *Angitia (Dioctes) trochanterata* Morl. *Theronia inareolata, Bracon brevicornis* Wesmael and *Apanteles* sp. all on larvae, and *Brachymeria euploeae* West. on pupae as natural parasites of *D. punctiferalis.* Patel and Gangrade (1971) reported *Microbracon hebetor* Say. parasitising 9.61% full grown larvae of *D. punctiferalis.* However, they observed two hyperparasites such as *Eurytoma* sp. and *Brachymeria* sp. parasitising the cocoons of *M. hebetor* collected from field. Joseph *et al.* (1973) recorded *Brachymeria nosatoi* Habu and B. *lasus* Westwood on *D. punctiferalis.* It was observed in this laboratory that a mermithid nematode in the rainy season and an ichneumonid parasite *Xanthopimpla australis* Kr. parasitising on the larvae and pupae of *D. punctiferalis* respectively (Dubey *et al.* 1978).

From the available information on the pest it is clear that *D. punctiferalis* is a serious pest of a number of annual and perennial crops and can easily change the hosts on finding adverse situations caused by insecticides, absence of a particular crop or any other biotic factors. Unless insecticidal cover is given at regular intervals, it may be rather difficult to ensure complete economic protection to crops from this pest. At the same time it projects the idea that an effective biological control agent or measure applied can become more promising and long lasting cover to all the crops. Therefore, it warrants that control measures have to be planned judiciously. The bionomics of the pest has been worked out only in castor and it is worthwhile if studied on other crops as well. On ginger and turmeric, studies are being carried out at CPCRI, Kasaragod currently.

The leaf roller: *Udaspes folus* Cram. Lepidoptora: Hesperiidae)

Lefroy (1906) recorded it as ginger caterpillar, green in colour with a dark head which lives inside the folded leaves and feeds on them. Fletcher (1914) listed its food plants as ginger, turmeric, wild lillies and *Alpinia nutans* (in Hong Kong, as reported by Kershaw). He found it in Northern Circars and Coimbatore and considered it to be a scarce insect at that time which could become a serious pest of ginger and turmeric. This butterfly *U. folus* was reported to make serious damage sometimes to ginger in South India (Anonymous 1927). Ayyar (1940) reported that the turmeric skipper *U. folus,* a black and white spotted butterfly was a specific pest of turmeric and arrow root (*Curcuma anqustifolia*). Abraham *et al* (1975) observed other zingiberaceous plants like *Elettaria cardamomum, Aframomum melequeta, Hedychium* sp. and

curcuma amada harbouring this pest. They studied its biology on ginger and turmeric under laboratory conditions. The average duration from egg to adult was recorded as 28.6 days on ginger and 25.1 days on turmeric with a longevity of 4 days for males and 6.7 days for females. Five larval instars were reported and the full grown caterpillar measured about 36 mm length. The pest was active in Kasaragod from August to October and indicated a possibility of pupal hibernation during off season. The natural parasites such as *Ceromya* sp. (Tachinidae) *Apanteles* sp. (Vipionidae), Sympiesis sp. (Euliphiade) and a mermithid nematode were recorded for 2 years parasitising 21.85 to 26.42 per cent of the insect during the crop season by Dubey *et al.* (1975-77). However, in August to October maximum parasitisation by *ceromya* sp., *Apanteles* sp. and mermithid nematode was 34.64 and 35 per cent respectively. (Dubey *et. al* 1976-77). They recorded a pupal parasite *Brachymeria coxodentata* Joseph *et al* (Chalcididae). Abraham and Pillai (1974) isolated two bacteria *Enterobacter cloacae* and *Pseudomonas* sp. from the diseased caterpillars of *U. folus* collected from the field and found the former to be a potential pathogen.

From the foregoing account, it may be seen that *U. folus* is not a very serious pest normally and it has a number of potential natural enemies. The only limitation is their occurrence during a particular season. For example the mermithid nematode is active only during rainy season, when the pest population is also at its peak (August to October). The natural enemy complex could further be harnessed by careful exploitation of their seasonal occurrence and parasitic behaviour for the suppression of the pest more effectively. This involves elaborate studies on the bionomics of the natural enemy complex and the possibility of mass culturing the potential species.

Mimegralla coeruleifrons Macquart (Diptera: Micropezidae)

Maggots of the dipteran flies *Mimegralla coeruleifrons* and *Eumerus* sp. were found associated with the soft rot disease affected rhizomes of ginger from August onwards. This is a very serious problem in ginger. These maggots are suspected to cause complete damage to the rhizomes by feeding and could pave way for the invasion by the fungus *Pythium* sp., resulting in rotting of rhizomes (Anonymous 1978). The maggots also attacked *Curcuma aromatica* and *C. zedoaria.* A parasite Trichopria sp. (Diapridae: Hymenoptera) was reared from its puparia. The maggots on culturing yielded *Fusarium* sp. and a bacterium both being nonpathogenic on ginger. The pupal period of *M. coeruleifrons* was found to be 6-10 days (Anonymous 1977 B).

The scale insect: *Aspidiotus hartii* Green (Homoptera: Diaspididae)

A pale grey hard scale insect *Aspidiotus hartii* had been reported to infest turmeric haulms in Tamilnadu (Ayyar 1940). Nair (1975) stated that the ginger rhizomes affected by this circular hard scale, dry up and get dessicated when stored. Ragupathy *et al.* (1976) from Coimbatore reported that it infests the turmeric rhizomes in the field and during storage. When infested rhizomes are used as seed materials, they further multiply and cause damage to haulms. When infestation is severe, the sprouting or rhizomes itself is affected adversely. They studied the field reaction of 191 turmeric types/selections to rhizomes scales and found that 87 were completely free from scale infestation. This scale also infests yam *Amorphophallus companulatus* Blume. Another species *A. cucumae* Green infested turmeric in Maharashtra (Nair 1975).

Lema Praeusta Febr., *L. singnatipennis* Jac. *L. semiregularis* Jac. *L. lacordairei* Baly (Coleoptera: Criocerinae)

These are minor pests of turmeric, the former three species recorded in Orissa and the latter from Kerala. Their bionomics have been worked out in Orissa by Sengupta and Behura (1957). *L. praeusta* adults paired after 4-5 days of emergence and laid eggs singly on the leaves, 8 to 10 days later. The grub fed on the leaf tissue and pupated usually in soil. The adults were active during day and fed on leaves. The egg, larval and pupal stages lasted 8-10, 10-12, and 15-25 days respectively. The longevity was 43 to 60 days. *L. praeusta* was observed feeding on the leaves of cucurbits, brinjal and sorghum in the field.

The other recorded pests of ginger and turmeric in field do not cause any serious economic damage to these crops. However, their biology, bionomics, etc. are to be studied in view of their potentiality of becoming major pests, under favourable conditions.

Storage pests: The drug store beetle *Stegobium paniceum L.* and Cigarette beetle *Lasioderma serricorno* F (Coleoptera: Anobiidae)

These are almost ubiquitous insects found in stores houses on a number of products like cereals, pulses, processed foods, spices etc. These insects can complete their lifecycle in about 25 to 35 days at an optimum temperature of 30°C and 60% R.H. and are found throughout the year when favourable conditions prevail. Muthu and Majunder (1974) suggested a number of measures to control these pests. Insects die if their body temperature is raised to 60°C for 5 or 10 minutes and they recommended an infra-red heat disifestation unit for this purpose. For large quantities of bulk materials, fumigation with aluminium phosphide

tablets of methyl bromide will be quick, efficient, economic and safe method of disinfestation. Fumigation treatment coupled with a prophylatic spray with 1-2% malathion or the C.F.T.R.I. formulation based on DDT and Lindane will ensure insect free storage.

SUMMARY

This article brings out that the shoot borer, leaf skipper, the rhizome rotting flies, the rhizome scale and the leaf eating beetles, are the key pests of ginger and turmeric in the field. The storage pests are briefed. The biology, bionomics and control measures including the natural parasites of the pests are discussed.

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Abraham VA, Pillai GB and Nair CPR, 1975: Biology of *Udaspes folus* Cram. (Lepidoptera: Hesperiidae) the leaf roller pest of Turmeric and ginger. *J Plant Crops* 3 (2): 83-85.

Abraham VA and Pillai GB, 1974: Biology and bionomics of insect pests. In CPCRI Annual Report 1973 p. 153.

Anonymous 1927: Ginger its cultivation, preparation and trade. *Rev Appl Ent* 15 (1927): 667-682.

Anonymous 1940: Memoirs of Dept. of Agric., Madras, Supdt. Govt. Press Madras No. 36 of 1954 p. 1088.

Anonymous 1943: Queensland annual report of the Dept. of Agri and stock for year 1943-46 *Rev Appl Ent* 35 (1947): 243.

Anonymous 1952: Administrative report of Subordinate Officers of Dept Agri Madras for 1951-52. Quoted in *Indian Oilseeds* J 7, 8: 146-58.

Anonymous 1960: Annual progress report of the scheme for building up named reference collection of insects in Andhra Pradesh (Agrl Coll Bapatla). (1959-60). Quoted in Indian Oilseeds J 8: 146-58.

Anonymous 1977 (A): *Indian Arecanut, spices and Cocoa Journal* 1 (2): 54.

Anonymous 1977 (B): CPCRI Annual report 1976.

Anonymous 1978: Biology and Bionomics of insect pests of spices. AICSCIP Progress Report 1976-77. CPCRI Kasaragod p. 38.

Ansari MA Rahman 1946: Short notes and exhibits *Rev Appl Ent* 36 (1948): 123.

Ayyar TVR 1940: *Hand Book of Economic Entomology for South India*, pp. 339. Supdt Govt Press Madras.

Channabasavanna GP, 1954: Insect pests of some cash crops-nature of damage and control. Mysore Agric calendar and yearbook. Quoted in *Indian Oilseeds J* 8: 146-158.

Chopra RL 1928: Annual report of the Entomologist to the Govt of Punjab, Lyallpur for the year 1925-26. Quoted In *Indian Oilseeds J* 8: 146-158.

David BV, Narayanaswamy PS and Murugesan M 1964. Bionomics and control of the castor shoot and capsule borer, *Dichocrocis punctiferalis* Gn in Madras State. *Indian Oil Seeds J* 8: 146-58.

Dubey OP, Pillai GB and Vijay Singh 1976: Biology and bionomics of insect pests. In CPCRI Annual Report 1975: 154.

Dubey OP, Pillai GB and Vijay Singh 1977: Biology and Bionomics of Insect pests of spices. CPCRI Annual Report (1976): 173.

Fletcher TB, 1914, Some South Indian Insects. PP. 420. Supdt. Govt. Press, Madras.

Fletcher TB, 1922, Report of the Imperial Entomologist. Quoted in *Indian Oilseeds J.* 8: 146-158.

Hussain MA, 1924, Annual Report of the Entomologist of Govt. of Punjab, Lyallpur for the year 1922-23. Quoted in *Indian Oilseeds J.* 8: 146-158.

Joseph KJ, Narendran TC and Joy PJ 1973, Studies on oriental Brachymeria (Chalcidoidea). A report of the work done under P.L. 480 research project, entitled Taxonomic studies of the oriental species of Brachymeria (Hymenoptera: Chalcididae) University of Calicut, Calicut.

Kannan K and Nair KP, Vasudevan 1965, *Zingiber officinale* (ginger) in Kerala. *Madras agri. J.* 52 (4): 168-176.

Katyal SL, 1974, Contribution of ICAR towards the production of spices in India. Symposium on Development and prospects of Spice Industry in India. CFTRI Mysore.

Lefroy HM 1906, *Indian Insect pests* P 318. Supdt. Govt. Printing Press, Calcutta.

Mamet R 1940, Some new genera and species of coccide from Mauritius *Rev. appl. Ent.*, 28 (1940): 320.

Mohan Singh 1941, New host plants of some Indian Insect of economic importance. *Indian J. Ent.* 3: 141.

Muthu M and Majumder SK 1974, Insect control in spices. Symposium on Development and prospects of spices Industry in India, CFTRI, Mysore.

Nair MRGK 1971, Pests of spices. Background paper presented at the first workshop of AICSCIP, CPCRI, Kasargod (October 1971).

Nair MRGK 1975, *Insects and Mites of Crops in India*, P. 404. ICAR, New Delhi.

Nambiar MC, Pillai GB and Nambiar KKN 1976, Diseases and pests of Cardamom — a resume of research in India. *Pesticides Annual* 1975.

Narayanan ES 1959, Insect pests of castor. Quoted in *Indian J. Agric. Sci.* 41 (5): 443-444.

Patel RK and Gangrade GA 1971, Note on the biology of castor capsule borer, *Dichocrocis punctiferalis. Indian J. Agric. Sci.* 41 (5): 443-444.

Pillai GB and Abraham V 1974, Chemical control of pests. CPCRI Annual report 1973 P. 154.

Puttarudriah M and Channabasavanna GP, 1951, *Dichocrocis punctiferalis* Guen. (Castor pod Borer) on *Andropogon Sorghum* in Mysore. *Curr. Sci. 20*: 100.

Raghupathy A, Santharam G, Balasubramanian M and Arumugam 1976, Occurrence of the scale, *Aspidiotus hartii* Gr. on different types of turmeric *J. Plant Crops* 4 (2): 80.

Reddy DB 1968, *Plant Protection in India*. P. 311. Allied Publishers.

Rodrige E 1941, Administration report of the acting Director of Agri. for 1940 Colombo 1941. *Rev. appl. Ent.* 30 (1942): 338.

Sarma YR, Nambiar KKN, Brahma RN and Sathiamma B, 1977, Rhizome rot of ginger and turmeric. In CPCRI Annual Report 1976. P. 170-171.

Sengupta GC and Behura PK 1955, Some new records of crop pests from India. *Indian J. Ent.* 17 (2): 283-285.

Sengupta GC and Behura BK 1956, Note on the life history of *Lema semiregularis;* Jac. *J. Bombay Nat. Hist. SOC.* 53 (3): 484-485.

Singhvi SM, Balan JS and Yadava TP 1971, Preliminary studies on the relative efficacy of different insecticides for the control of castor shoot and capsule borer *D. punctiferalis* on castor. *Haryana agric. Univ. J. of research.* 1(4): 45-47.

Sloan WJS 1945, Insect pests of grain Sorghum. *Rev. appl. Ent.* 34 (1946): 387.

Srivastava BK 1959, *Stegobium paniceum* as a pest of stored turmeric in Rajasthan and its control by fumigation. *Rev. appl. Ent.* 47.450.

Srivastava ML, 1971, *Dichocrocis punctiferalis* as a pest of mango. *Entomologists' News letter* 1(8): 57.

Sulochana Bai B, Radha NV and David BV 1968, Control of the castor shoot and capsule borer *Madras agric. J.* 55 (11): 470-473.