

An Illustrative Guide for Trapping, Monitoring & Identification of Economically Important Fruit Flies



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FOREWORD



Tephritid fruit flies are responsible for postharvest losses in fresh fruits and vegetables, in addition they are also major impediments for export. The pre-harvest management by using para-pheromones is highly effective in controlling fruit flies in the field. Due to the constraints such as high cost of commercial traps/ lures and their timely accessibility, the small and marginal farmers are not able to use this approach effectively in India. Realizing the importance of low-cost traps and lures for the benefit of the farmers, NIPHM is popularizing the concept of preparing low-cost bottle trap, lures and its use by the farmers. The preparation procedures are included in this booklet.

This “An Illustrative Guide for Trapping, Monitoring & Identification of Economically Important Fruit Flies” booklet and the Fruit Fly Reference Specimen Kit has taken shape due to the commitment and personal involvement of Dr. N. Sathyanaryana and Mrs. S. Latha. I congratulate them for their efforts and hope this booklet will be useful to progressive farmers, students, teachers, researchers and extension officials involved in area-wide control, trapping and monitoring fruit flies. It will aid efforts to document the prevalence, predominance as well as absence of specific fruit fly species in different States/ Agro-climatic zones in India.


Mrs. V. Usha Rani, IAS
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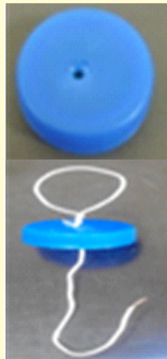
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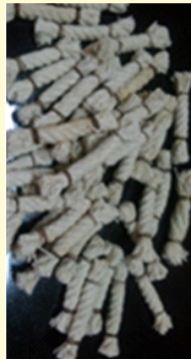
LOW-COST BOTTLE TRAP PREPARATION



Take 1 litre empty water bottle. Remove wrapper. Make 3 windows with a knife at 3 inches from top. Each window should be of 1 inch size.



Make a small hole in the centre of the cap with needle. Take a thin wire of 10 inches length, make a knot at the centre, insert the wire from inside to outside the cap and make a loop for hanging the bottle & other end make a hook for tying lure inside the bottle.



Take ½ inch thick cotton rope & cut the rope into 2 inches size, tie the cut ends with thin wire.

PREPARATION OF LURES



Methyl Eugenol: Mix Ethyl Alcohol-60 ml + Methyl eugenol-40ml + Malathion/ DDVP (pesticide)- 20ml (i.e. in the ratio of 6:4:2). Use in Mango, Guava, Papaya, Citrus and other fruit crops.



Cue Lure: Mix Ethyl Alcohol-60 ml + Cue lure (p-Acetoxyphenylbutanone-2)-40ml + Malathion/ DDVP (pesticide)- 20ml (i.e. in the ratio of 6:4:2). Use in Cucumber, Gherkin, Melon, Pumpkin, Bitter gourd, Snake gourd, Mango etc.

PLACEMENT OF TRAPS & LURES



Dip the cut cotton rope pieces in ME / Cure lure for 24 hours. Cover the lures with aluminium foil until use. The 120 ml mixture can be used for preparing 30 lures i.e. @ 4ml / lure.



Remove one third of aluminium foil at the time of use and tie the lure to the thin wire in the lid



Hang the bottle in shade at least 3-4 feet above ground level at different locations.

GENERAL PRECAUTIONS

The lures are to be prepared in well ventilated room wearing disposable hand gloves. Separate containers and measuring jars are to be used while preparing the lure mixtures. Cost of ME and Cue lure is approximately Rs.35/- for one bottle trap. 6 -10 traps/acre are required to be used for best control. Lures are to be replaced once in 30-40 days. Methyl eugenol lure can be used in all type fruit crops from fruit set to harvest. Cue lure can be used in cucurbitaceous and solanaceous vegetable crop fields from flowering till harvest. For effective monitoring one trap/acre can be used after harvest i.e. throughout year to avoid population buildup on alternate hosts.

FRUIT FLY SPECIFIC LURES

Methyl Eugenol Lure

Bactrocera affinis

Bactrocera amarambalensis

Bactrocera caryeae

Bactrocera correcta

Bactrocera diversa

Bactrocera dorsalis

Bactrocera verbascifoliae

Bactrocera versicolor

Bactrocera zonata

FRUIT FLY SPECIFIC LURES

Cue Lure

Bactrocera andamanensis

Bactrocera albistrigata

Bactrocera caudata

Bactrocera cucurbitae

Bactrocera digressa

Bactrocera fastigiata

Bactrocera gavis

Bactrocera incisa

Bactrocera limbifera

Bactrocera nigrofemoralis

Bactrocera neonigrotibialis

Bactrocera melastomatos

Bactrocera merapiensis

Bactrocera pallescentis

Bactrocera paraosbeckiae

Bactrocera scutellaria

Bactrocera scutellaris

Bactrocera trilineata

Bactrocera tau

Bactrocera vishnu

Dacus longicornis

Dacus ramanii

Dacus sphaeroidalis

Bactrocera caryeae (Kapoor)



Adult Male



Lateral view & Legs



Face



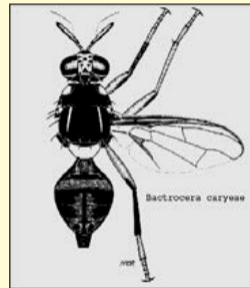
Wing



Thorax



Abdomen



Line diagram

Bactrocera caryeae (Kapoor)

Distinguishing Characters: Medium sized insects. **Face:** With two elongate, oval, black facial spots. **Thorax:** Scutum mostly black; two narrow lateral postsuturalvittae which are either parallel sided or narrowing slightly posteriorly, medial vitta absent; scutellum yellow with a broad black basal band. Postpronotal lobes yellow. **Wing:** Clear wing membrane, narrow costal band (not reaching R4+5) and remaining very narrow around apex of wing; cells bc and c colourless and devoid of microtrichia.; a narrow anal streak, within cell Cup. **Legs:** Black preapical spots on outer surfaces of fore femora and inner surfaces of mid and hind Femora. **Abdomen:** with a medial dark stripe on T3-T5 and dark marks on the abdomen. a pair of oval orange-brown shining spots on tergum V. Posterior lobe of male surstylus short; female with aculeus tip needle shaped.

Host range: Golden apple, Pummelo, Mandarin, Mango, Mammey sapote, Guava etc.

Known Distribution in India: Goa, Karnataka, Kerala, Tamil Nadu

Attracted To: Methyl Eugenol lure

Bactrocera caudata (Fabricius)



Adult Male



Lateral view & Legs



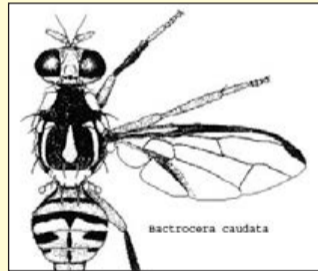
Face



Wing



Thorax & Abdomen



Line diagram

Bactrocera caudata (Fabricius)

Distinguishing Characters: **Face:** a black transverse line across mouth opening extended laterally and almost forming a line across the mouth opening; **Thorax:** Scutum predominantly black; with lateral and medial yellow stripes; medial vitta narrow anteriorly and broadened posteriorly giving the appearance of a spatula; with anterior supra alar setae, prescutellar setae, 4 scutellar setae. **Wing:** Costal band expanded into an apical spot; **Abdomen:** T3-T5 tergites with medial dark stripe and a transverse dark line on T3; with separate dark areas on anterolateral margins of T3-T5; **Male:** posterior lobe of surstylus long; **Female:** apex of aculeustrilobed.

Host Range: Bitter Snake gourd (*Trichosanthes palmata*), Snake gourd (*Trichosanthes anguina*), Tomato (*Lycopersicon esculentum*), Bryonia laciniosa, Citrus sp., Pumpkin (*Cucurbita moschata*)

Known Distribution in India: Assam, Bihar, Karnataka, Kerala, Meghalaya, Sikkim, Telangana, Uttaranchal, West Bengal

Attracted To: Cue lure

Bactrocera correcta (Bezzi) - Guava Fruit Fly



Adult Male



Lateral view & Legs



Face



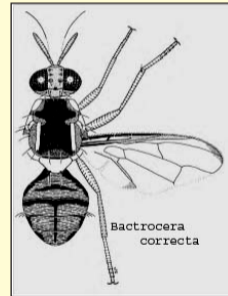
Wing



Thorax & Abdomen



Mesopleural stripe



Line diagram

Bactrocera correcta (Bezzi) - Guava Fruit Fly

Distinguishing Characters: **Face:** pair of transverse elongate black spots almost meeting in centre. **Thorax:** black in colour dark red-brown along lateral and posterior margins; broad parallel sided lateral postsuturalvittae; medial postsuturalvitta absent; scutellum yellow with narrow black basal band. **Wing:** wings with cells bc and c colourless, both cells entirely devoid of microtrichia, a narrow pale fuscous costal band confluent with R2+3 and ending at apex of this vein, a small oval fuscous spot across apex of R4+5, anal streak absent but with a pale fuscous tint within cell cup. **Legs:** All segments of legs entirely fulvous except hind tibiae pale fuscous. **Abdomen:** Abdomen reddish brown with abdominal terga III-V red-brown with a 'T' pattern; , a pair of oval red-brown shining spots on tergum V. **Male:** posterior lobe of male surstylus short; Male tergite 3 with a pecten on each side. **Female** with aculeus tip needle shaped.

Host Range: Guava, Papaya, Citrus, Melon, Mango, Sapota, Plantain, Cherry, Peach, Ber etc.,

Known Distribution in India: Andhra Pradesh, Bihar, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Punjab, Tamil Nadu, Telangana, Uttar Pradesh, West Bengal

Attracted To: Methyl Eugenol lure

Bactrocera cucurbitae Coquillett – Melon fruit fly



Adult Male



Lateral view & Legs



Face



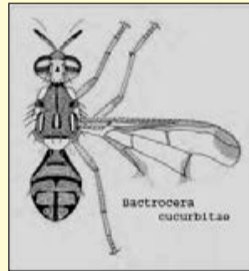
Wing



Thorax



Abdomen



Line diagram

Bactrocera cucurbitae Coquillett – Melon fruit fly

Distinguishing Characters: **Face:** with two round to elongate spots. **Thorax:** Predominant colour of scutum red-brown. Scutum with parallel sided lateral postsuturalvittae, yellow in colour, which extend anterior to suture and posteriorly to level of the intra-alar setae. Medial vitta present; not extended anterior to suture. Scutellum yellow, except for narrow basal band. **Wing:** Wing with a complete costal band; depth sometimes reaching R4+5. Costal band expanded into a spot at apex (big apical spot), which extends about half way to M. With an anal streak. a transverse mark over crossvein r-m. Always with transverse mark over crossvein dm-cu. **Legs:** All femora pale basally, red-brown apically. **Abdomen:** Orange-brown, transverse band across tergites 3 & 4. Male tergite 3 with a pecten (setal comb) on each side.

Host Range: Cucumber, Melon, Bitter gourd, Snake gourd, Smooth gourd, Little gourd, Pumpkin, Gherkin and other Cucurbitaceous crops; Mango, Citrus, Papaya, Guava and many fleshy fruits & Cowpea

Known Distribution in India: Andaman & Nicobar, Andhra Pradesh, Assam, Bihar, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand, West Bengal

Attracted To: Cue lure

Bactrocera digressa Radhakrishnan



Adult Male



Lateral view & Legs



Face



Wing



Thorax & Abdomen



Mesopleural stripe

Bactrocera digressa Radhakrishnan

Distinguishing Characters: Medium sized insects. **Face:** Elongate, brown to black spots. **Thorax:** Reddish brown Scutum, with narrow lateral vittae, median vittae absent, scutellum yellow, except for a narrow basal band. Absence of acrostichal and anterior supra-alar setae. **Wings:** costal band slightly overlapping R2+3, with a anal streak. **Legs:** All femora with red-brown colour. **Abdomen:** Reddish brown with thin 'T' shaped mark. **Male** tergite 3 with a pecten on each side. **Female** with bifid aculeus tip.

Host Range: *Alangium salviifolium*, Not much information.

Known Distribution in India: Karnataka, Tamil Nadu, Telangana

Attracted To: Cue Lure

Bactrocera diversa (Coquillett)



Adult Male



Lateral view & Legs



Male Face



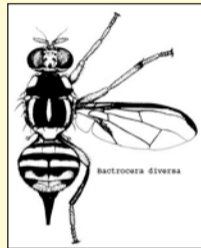
Wing



Thorax



Abdomen



Line diagram

Bactrocera diversa (Coquillett)

Distinguishing Characters: Adult small to medium size with greenish black body. **Face:** Sexual dimorphism is seen in this species. Face of male entirely yellow, without facial spots, face of female with a transverse black line above the mouth opening. **Thorax :** Scutum dark with lateral vittae parallel sided reaching ia setae. with medial postsuturalvitta narrowed at both ends. **Wings:** with costal band confluent with R2+3. **Legs:** All femora without any markings. **Abdomen:** Light brown with dark markings on T2 and T3. Males lack pecten on 3rd abdominal tergite.

Host Range: Cucurbits

Known Distribution in India: Andhra Pradesh, Bihar, Himachal Pradesh, Karnataka Maharashtra, Meghalaya, Punjab, Tamil Nadu, Telangana, Uttaranchal, Uttar Pradesh, West Bengal

Attracted To: Methyl Eugenol lure

Bactrocera dorsalis (Hendel) – Mango fruit fly



Adult Male



Lateral view & Legs



Male Face



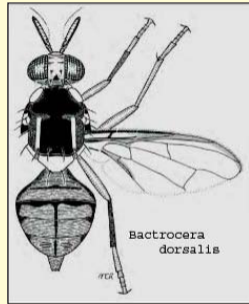
Wing



Thorax & Abdomen



Mesopleural stripe



Line diagram

Bactrocera dorsalis (Hendel) – Mango fruit fly

Distinguishing Characters: Medium sized insect. **Face:** Yellowish with two separate black facial spots. **Thorax:** With yellow parallel lateral vittae on black scutum. No median vitta. **Wings:** with continuous costal band confluent with R_{2+3} . **Legs:** All femora yellow without any fuscous markings. **Abdomen:** orange red with a prominent T shaped mark. Male tergite 3 with a pecten on each side.

Host range: Mango, Citrus, Papaya, Guava, Pomegranate, Apple, Litchi, Sapota, and many fleshy fruits; Cucumber, Melon, Bittergourd, Coffee, etc.

Known Distribution in India: Andhra Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand, West Bengal

Attracted To: Methyl Eugeonol lure

Bactrocera gavis (Munro 1935)



Adult Male



Lateral view & Legs



Face



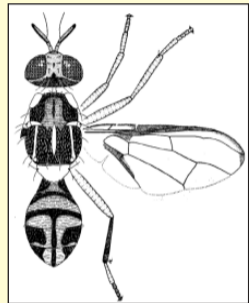
Wing



Thorax & Abdomen



Mesopleural stripe



Line diagram

Bactrocera gavis (Munro 1935)

Distinguishing Characters: **Face:** with large oval black spots. **Thorax:** Scutum shining black with lateral postsuturalvittae widening posterior to iasetae to almost contact the scutellum. Moderately broad medial postsuturalvitta, tapering anteriorly and posteriorly. Scutellum yellow except for a narrow black, basal band. Mesopleural stripe an inverted 'L' shape and extending to postpronotal lobe. **Wing:** with continuous costal band confluent with R2+3 and widening slightly across apex of R4+s. **Legs:** segments fulvous except hind tibiae fuscous. **Abdomen:** Tergum I orange-brown with broad lateral black markings, Tergum II with narrow black marking across anterior margin and widening posteriorly. Terga III-V with 'T' shaped mark. A pair of oval shining spot on Tergum V. Male with pectan in Tergum III.

Host Range: Not known

Known Distribution in India: Karnataka, Kerala, Orissa, Tamil Nadu, Telangana

Attracted To: Cue lure

Bactrocera nigrofemoralis White & Tsuruta 2001



Adult Male



Lateral view & Legs



Face



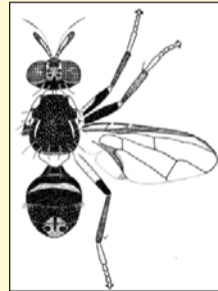
Wing



Thorax



Abdomen



Line diagram

Bactrocera nigrofemoralis White & Tsuruta 2001

Distinguishing Characters: Small insects. **Face** entirely shining black. **Thorax:** Scutum shining black without pale markings. Narrow postssuturalvittae, narrowing posteriorly well before ia setae. Scutullem yellow with a moderately broad black basal band. **Wings:** Costal band confluent with R2+3 and remaining narrow to end just beyond extremity of R4+5. A narrow anal streak. **Legs:** Fore femora shining black, Mid femora entirely shining black, hind femora apical with shining black. **Abdomen:** Mostly shining black. Narrow brown colour band on Tergum II. Pair of oval shining black spot on Tergum V. Pectan present on Tergum III of Male.

Host Range: *Terminalia catappa*.

Known Distribution in India: Karnataka, Kerala, Tamil Nadu, Telangana

Attracted To: Cue lure

Bactrocera tau Walker



Adult Male



Lateral view & Legs



Face



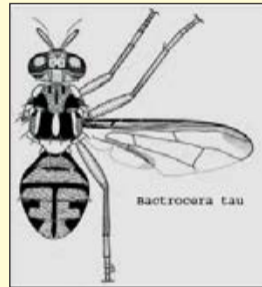
Wing



Thorax



Abdomen



Line diagram

Bactrocera tau Walker

Distinguishing Characters: **Face:** with round facial spots. **Thorax:** Scutum orange brown and marked with black, and with lateral postsutural vittae extending beyond ia setae, and with medial vitta. Scutellum with basal and apical setae. **Wing** with costal band overlapping vein R2+3 and expanded apically into a big spot which reaches about half way to M. With an anal streak. **Legs:** Fore femur yellow / pale, sometimes with a dark preapical spot. Mid and hind femora pale. **Abdomen:** Predominant colour orange-brown. Tergite 3 with a transverse band. Tergite 4 either with antero-lateral rectangular marks or dark laterally. Medial longitudinal stripe on T3-5. Male with pecten on third abdominal tergum.

Host Range: Bitter gourd, Cucumber, Melon, Watermelon, Pumpkin, Ridge gourd, Smooth gourd, Snake gourd and many Cucurbits, Mango, Sapota, Guava, Longan, & Bean

Known Distribution in India: Andaman & Nicobar Islands, Arunachal Pradesh, Bihar, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Meghalaya, Punjab, Sikkim, Tamil Nadu, Uttaranchal, West Bengal

Attracted To: Cue lure

Bactrocera versicolor Bezzi



Adult Male



Lateral view & Legs



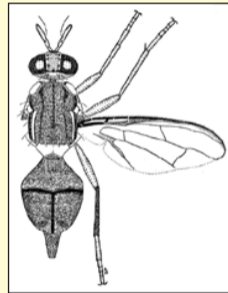
Face



Wing



Thorax & Abdomen



Line diagram

Bactrocera versicolor Bezzi

Distinguishing Characters: Medium sized, red-brown species. **Face:** with medium sized black spots. **Thorax:** Scutum red-brown, with two medium sized, parallel, yellow lateral vittae, ending just behind ia setae. Scutellum yellow with narrow brown basal band and an apical spot. **Wings** with a narrow costal band confluent with R_{2+3} and ending just beyond R_{4+5} and a very narrow anal streak within cell cup. **Legs:** All femora fulvous except for a sub-apical spot on outer surfaces of fore and mid-femora. **Abdomen** Red-brown with thin 'T' shaped markon Terga III-V. Dark red-brown shining spot on Tergum V. Males with pectan on Tergum III.

Host Range: Sapota

Known Distribution In India: Bihar, Karnataka, Kerala, Tamil Nadu, Telangana

Attracted To: Methyl Eugenol lure

Bactrocera vishnu Drew & Hancock



Adult Male



Lateral view & Legs



Face



Wing



Thorax



Abdomen

Bactrocera vishnu Drew & Hancock

Distinguishing Characters: Medium sized species. **Face:** with large oval facial black spots. **Thorax:** Scutum mostly black, with two medium sized, parallel, yellow lateral vittae, ending just behind ia setae. Scutellum yellow with narrow black basal band. **Wings** with a narrow costal band slightly overlapping R_{2+3} and a narrow anal streak within cell cup. **Legs:** All femora fulvous except for an oval sub-apical black spot on outer surfaces of fore-femora. **Abdomen** Terga III-V with a 'T' shaped mark, a dark transverse band across Tergum III, broader laterally. Narrow transverse fuscous marks on Terga IV and V and a pair of oval fuscous shining spot on Tergum V. Males with pectan on Tergum III.

Host Range: Not known

Known Distribution in India: Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana

Attracted To: Cue lure

Bactrocera zonata (Saunders, 1841) – Peach Fruit Fly



Adult Male



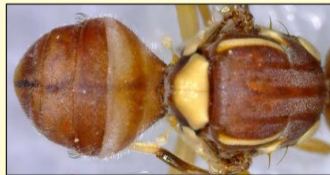
Lateral view & Legs



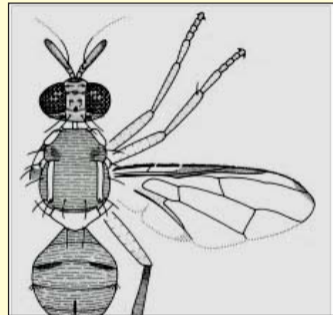
Face



Wing



Thorax & Abdomen



Line diagram

Bactrocera zonata (Saunders, 1841) – Peach Fruit Fly

Distinguishing Characters: Adult pale orange brown to red species. **Face** with median sized oval black spots. **Thorax:** Scutum red-brown, with two lateral yellow vittae of medium size extending beyond ia. Setae. Anterior supra alar setae, prescutellar setae, 2 scutellar setae present. Scutellum yellow with narrow dark red-brown basal band. **Wing** with discontinuous costal band confluent with R2+3 and ending at apex of this vein, a small oval spot apically. **Legs:** Fulvous with apices of femora red-brown. **Abdomen:** reddish brown with Terga III–V with 'T' shaped mark. Male with pecten on third tergum.

Host Range: Apple, Citrus, Fig, Quince, Mango, Papaya, Peach, Pomegranate & Bitter gourd, and some cucurbits

Known Distribution in India: Andhra Pradesh, Assam, Bihar, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Punjab, Tamil Nadu, Telangana, Uttaranchal, Uttar Pradesh, West Bengal.

Attracted To: Methyl Eugenol lure

Dacus ciliatus Lowe



Adult Female



Adult Male



Lateral view & Legs



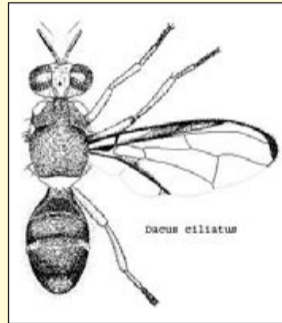
Wing



Thorax & Abdomen



Face



Line diagram

Dacus ciliatus Lowe

Distinguishing Characters: Adult predominantly orange species. **Face** with 2 facial spots. **Thorax:** 2 scutellar setae, a yellow spot covering most of the katatergite, anatergite orange, mid femur yellow or orange-yellow. Scutum without yellow stripes, anterior supra-alar setae and prescutellaracrostichal setae. No lateral or medial vittae. **Wing** with a costal band that is expanded apically to form a spot. **Legs:** predominantly yellow, slightly darkened to orange at apex of each femur. **Abdomen:** All tergites fused into a single plate, at most with smooth transverse lines marking the boundaries of each segment. **Male** with pecten on each side of tergum III.

Host Range: Bitter gourd, Bottle gourd, Cucumber, Ridge gourd, Melon, Watermelon, Snake gourd and many cucurbits. Citrus, Tomato

Known Distribution in India: Bihar, Chandigarh, Delhi, Gujarat, Himachal Pradesh, Karnataka, Maharashtra, Meghalaya, Punjab, Tamil Nadu, Telangana, Uttar Pradesh

Attracted To: Not attracted any lure.

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Image courtesy Mrs. S. Latha, Scientific Officer (PRA), NIPHM, Hyderabad

Line diagrams courtesy Australian Handbook, 2011 and Drew & Raghu, 2011

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