

AN ECOTAXONOMIC KEY FOR IDENTIFICATION  
OF TEA PESTS IN THE FIELD  
(INSECTS AND MITES)

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Ecology is the study of living organisms in relation to their organic and inorganic environment. The word 'ecology', coined by the German Zoologist, Earnst, Haeckel, is derived from the Greek word 'oikos' meaning 'place to live'. Ecology deals with the behaviour of organisms in their habitat.

Importance of insects is largely determined by their behaviour and effect on the environment. It is the insect's behaviour affecting man's interests that significantly determines its status as a pest. Therefore identification of an insect in relation to its ecology is a useful basis in dealing with pests in agricultural crops.

The organisms that fall into the category of 'Pests' in the ecosystem of tea fields are many (see Fig. 1). Their behaviour and effect on the ecosystem are varied. The correct identification and complete study of an organism is a prerequisite for its control. A systematic study of tea pests necessitates some scheme of classifying them. Animals can be classified in various ways. The usual classification used by zoologists is one based primarily on morphological/structural characteristics.

# MATURE LEAVES

## PLUCKING TABLE

- 1-YELLOW MITE
- 2-APHIDS
- 3-T-TORTRIX
- 4-T-LEAF ROLLER

- 1-T-TORTRIX
- 2-NETTLE GRUBS
- 3-GEOMETRIDS
- 4-PSYCHIDS
- 5-R-S-SCARLET MITE.
- 6-SCALES
- 7-BUGS

PURPLE MITES.

## YOUNG STEM

- 1-SCALE INSECTS
- 2-MEALY BUGS.

## BUSH FRAME

- 1-L.C-LIVE WOOD - TERMITE.
- 2-SCAVENGERS

## MATURE STEM

- (BROWN STREAKY)
- 1-S.H.B.
  - 2-RED BORER

## COLLAR

- 1-LIVE WOOD TERMITES
- 2-SCAVENGERS

## COLLAR + ROOTS

- 1-WHITE GRUBS
- 2-UP COUNTRY L.W. - TERMITES.

ROOTS - UP COUNTRY L.W. TERMITE.

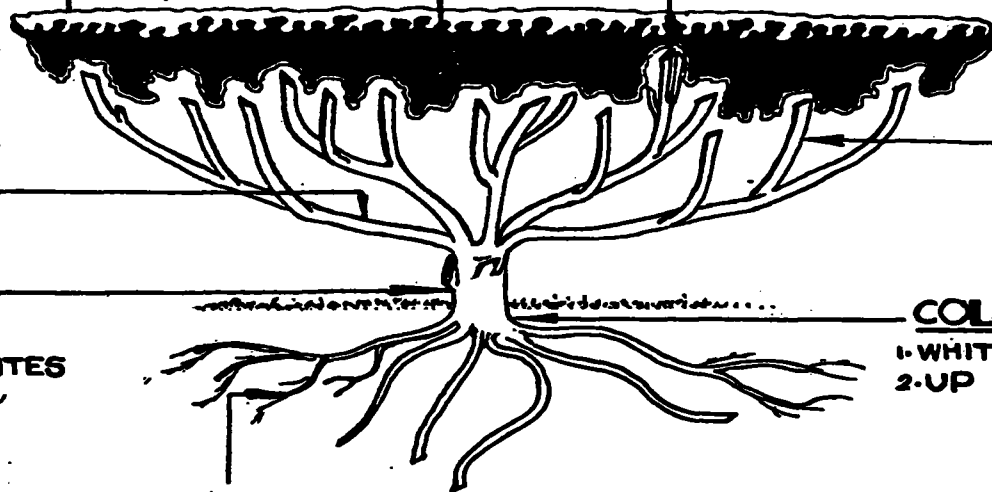


Fig. 1 - Site of feeding of tea pests

Ecological aspects, in other words, the expression of an insect's behaviour when used as a basis of classification of crop pests, makes it more of a practical system useful to the farmer/planter than a classification of organisms based on morphological characteristics. The science of classification is termed Taxonomy. Thus, a systematic classification of organisms based on their ecology can be referred to as Ecotaxonomy.

"Analytical keys" are devices used to identify things or organisms with reference to descriptive statements. All identification keys involve the same general principles (Borror, de Long and Triplehorn, 1981). One runs an insect or other organism through a key in steps, at each step he is faced with two, occasionally more, alternatives one of which should apply to the specimen at hand. Following the alternative that fits the specimen there will be a number or a name. If there is a number the next step is the couplet with this number. Thus, each step leads to another step and its alternative until a name is reached. At arriving at an identification, the student can work backwards in the key to confirm if the identification is correct.

In the following key, the numbering on the left hand side is as follows: The arithmetic number is the number of a particular statement couplet; the number appearing within brackets indicates where it is derived from; "a" and "b" refer to two alternatives to a particular statement and occasionally a third alternative is given as "c"; the arithmetic number appearing after a statement and on the right hand side indicates which statement to go to next.

When a statement ends up in an identification the scientific name of the pest is given within brackets and its common name without, below the statement and separated from it. A glossary of technical terms used in the key is given at the end of the key.

An index of scientific names of pests covered by this key is given at the end. Such an index is useful for checking back. Some specimens may key out in more than one place. This is so when there is significant variation in the expression of its behaviour. When an identification is made the planter should check the specimen against any illustrations or descriptions available. Colour pictures of pests which have appeared in the Institute's publications (Cranham, 1966; Senaratne, 1986; Vitarana, 1986) have been omitted from this paper. If these do not fit the specimen then either he has made a mistake somewhere down the key or it is a new pest that will not work out correctly in this key. Cranham (1966), Senaratne (1986) and Vitarana (1986; 1988) have described the biology and the ecology of these pests.

- |       |   |  |    |
|-------|---|--|----|
| 1     | a | Problem encountered in the plucking table or in shoot terminals of tea rested without plucking or in tender leaves of nursery plants; damage seen as discoloured/scorched/folded/damaged leaves. | 5  |
|       | b | Not as above.  | 2  |
| 2 (1) | a | Problem encountered in the foliage including both flush and maintenance leaves.  | 8  |
|       | b | Not as above.  | 3  |
| 3 (2) | a | Problem seen in the bush frame and may or may not be associated with wilting, scorching and/or death of plants.  | 26 |
|       | b | Not as above.  | 4  |

- 4 (3) a Problem seen only in the nursery by way of earth collected at the base of cuttings or made into structures covering the plants; plants may die or their growth is arrested. 43
- b Problem seen in the nursery but not in association with earthen structures; no visible damage to the aerial parts, but, plants may die or be weakened with arrested growth. 44
- 5 (1) a A leaf nest made by rolling a single leaf or many leaves together. 6
- b No leaf nest, but pluckable shoots showing a damage. 7
- 6 (5) a Single leaf rolled over from the apex downwards; the nest contains wet, blackish frass (excreta) of a caterpillar which when present appears dirty white or very pale green with a pale brown head; body not exceeding 15 mm in length; its feeding is confined to the surface of the leaf and does not eat through the leaf lamina; same leaf usually has marginal leaf roll made by the 1st stage larva (Fig. 2).

Tea Leaf Roller  
*(Gracillaria theivora*  
*-Caloptilia theivora)*

- b** Nest formed sometimes of one leaf rolled over from the side and the sides may be spun together, or else, two or more large leaves may be spun together; the nest accommodates a pale or dark green caterpillar with a shiny blackish head; parts of leaves are eaten away (Plate 33, Senaratne, 1986).

Tea Tortrix  
(*Homona coffearia*)

- 7 (5) a** Brownish corky appearance on either side of the midrib on the under surface of the flush; the corky area usually covers the whole of the midrib and may cover whole of the lower surface, the upper surface may have a wrinkled appearance. (Plate 4, Cranham, 1966).

Yellow Mite  
(*Hemitarsonemus latus*)

- b** Small blackish/brown and oval shaped organisms of different sizes (0.5 - 2 mm) on the under surface of flush and on tender stem of young branches, especially in tea recovering from prune and nursery plants. (Plate 55, Senaratne, 1986).

Tea Aphid  
(*Toxoptera aurantii*)

- c Uneven growth of tender leaves; leaf curls over and margins become recurved and subsequently turn brown resulting in the characteristic symptom referred to as "rim-blight"; greenish yellow grass hopper like insects may leap out.

#### Jassids

- 8 (2) a Leaf nests in the maintenance foliage as well as in the plucking table. 9
- b No leaf nests, but, maintenance foliage damaged. 10
- 9 (8) a Small leaf nest made of one or a few leaves not exceeding 3-4 leaves, like in 6b; the nest accommodates green or pale coloured caterpillar which drops down on a silk thread when the nest is opened up. Some nests may have brown cocoon masses of its parasite, *Macrocentrus* or the pupal stage of the caterpillar; a diseased caterpillar does not form the silk thread, instead drops to the ground. The leaves appear to have been eaten; a severely affected field appears scorched from far (Senaratne, 1986).

Tea Tortrix  
(*Homona coffearia*)

- b** Mostly large leaf nests, usually made of several leaves of one or more branches spun together and accommodating redish brown ants; the leaves of the nest are undamaged and stay green for several days.

Red ant  
(*Oecophylla smaragdina*)

- c** Dirty green coloured nests made out of cow dung like material (chewed up leaf of the same plant) and made around axils of branches and not spinning the leaves together; when dissected the nest is seen to be made of concentric chambers accommodating black ants about 6 mm long (Vitarana, 1988).

Black ant  
(*Crematogaster dorhni*)

- 10 (8) a** Only the lowermost of the maintenance foliage damaged as irregular holes on the laminae, and is very occasionally seen associated with a caterpillar, dull olive green in colour and growing up to 35 mm. Occurs, very occasionally, in low country and mid country districts.

Army worm  
(*Spodoptera litura*)

- b All maintenance foliage as well as leaves of the plucking table damaged. 11
- 11 (10) a Leaves exhibit holes on the laminae or parts of leaves eaten up (Plate 40, Senaratne, 1986). 12
  - b No holes or parts eaten away on the lamina but leaves look abnormal. 22
- 12 (11) a "Pin-pricks" or uneven holes which may be associated with necrotic spots; leaves have mutilated or puckered appearance; very localised in Sri Lanka. 13
  - b Holes or other eaten up areas have smooth edges not associated with necrotic tissue and no puckered appearance of leaves (Fig. 3). 14
  - c Leaf tissue is eaten away, leaving only the leaf cuticle, the mid-rib and veins, so that the leaves may be completely "skeletonised"; very occasional pest in Ramboda and Passara districts.

Tea Leaf Skeletonizer  
*(Piesmopoda rufimarginella)*  
 (Hampson)

- 13 (12) a A series of regular incisions in several rows length-wise on the leaf giving the appearance of stitches made by a sewing machine (Fig. 4).

"Sewing blight"  
(*Orasema spp.*)

- b Very small punctures (later becoming small holes as the leaves mature) are in the middle of tiny brown necrotic spots on the flush; the condition is referred to as "corroded flush"; as the leaves grow, the leaves become ragged and deformed; this is confined to the high country from 1200-2000 m (4000-6500 ft) (Fig. 5).

Lygus bug  
(*Lygus viridanus*)

- c Larger irregular slits/holes in the middle of necrotic patches roughly circular and about 3-5 mm across; the leaves become distorted and in severe attack the whole flush is blackened and is generally confined to Morawak Korale in the low country (Fig. 6).

Tea Mosquito bug  
(*Helopeltis spp.*)

- 14 (12) a Leaves carry legless, apparently stationary larvae of differently coloured flat bodies, with or without stinging hairs (nettles) on it; they glide on the leaf lamina at very slow speed.

- b Elongated, mobile caterpillars with variable body structures. 19
- c In addition to holes the leaf margin has scalloped appearance; but no larvae like in 'a' or 'b', instead, greenish blue or black coloured adult weevils of about 8 mm length seen crawling about; similar damage seen on Dadap and *Ghiricidia* (Fig. 7).

Leaf eating weevils  
*(Leprosus spp.,  
 Myllocerus curvicornis)*

- 15 (14) a Oval shaped larva with nettles or urticating spines on the body. 16

- b Slimy, oval shaped larva with naked (nettles absent) body. 17

- 16 (15) a Nettle grub growing up to 10 mm, is yellowish green to apple green with a dorsal stripe of pale yellow; there are 9 lateral tubercles bearing tufts of spines; a pair of anterior tubercles bear much shorter spines; very voracious feeder; outbreaks common in Uva; small, brown, oval shaped pupal cocoons among leaf debris (Plate 14, Cranham, 1966).

Fringed Nettle Grub  
*(Darna nararia  
 formerly  
 Macroplectra nararia)*

- b Nettle grub measuring up to 30 mm, is greenish-yellow and with 3 pale blue stripes each edged with dark blue or black, the middle stripes being very prominent; 3 pairs of prominent ruddy brown tufts, 2 anteriorly, 1 posteriorly; 4 rows of dorsal tubercles; occurs from sea level to over 1500 m (5000 ft) elevation (Plate 13, Cranham, 1966).

The Blue-striped  
Nettle Grub  
(*Parasa lepida*)

- c Nettle grub measuring up to 45 mm with a prominent white to brownish saddle like markings on the mid dorsal line of green coloured body, roughly globular pupal cocoons in leaf debris and resembles tea seeds; occurs mostly in Uva and in the low country (Plate 15, Cranham, 1966).

The Saddle-backed  
Nettle Grub  
(*Hindothosea cervina*  
formerly  
*Thosea cervina*)

17 (15)

- a Bluish, oval shaped, naked and slimy larva.

18



Fig. 2 – Marginal leaf-roll of 1st instar and leaf-nests of older instars of tea leaf roller larva



Fig. 3 – Early symptoms typical of red-slug, psychid and geometrid feeding



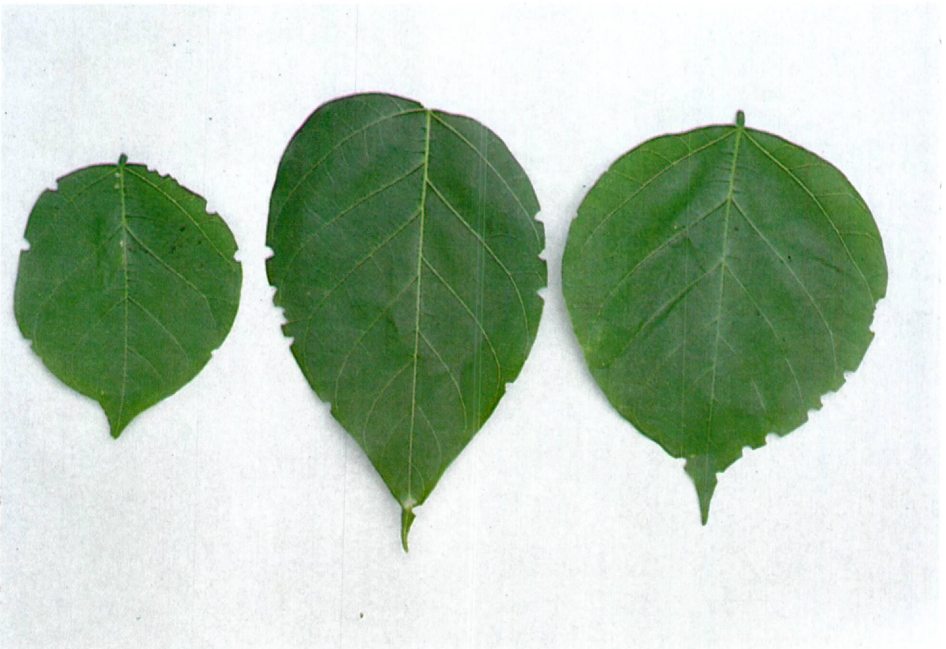
Fig. 4 – Sewing blight



Fig. 5 – "Corroded flush" of Lygus bug



*Fig. 6 – Damage symptoms of Tea mosquito bug (left)*



*Fig. 7 – Damage symptoms of leaf-eating weevil on Dadap*

- b Brick red coloured, superficially like a nettle grub but, lacking in stinging hairs; larva grows up to 30 mm, the body carries six longitudinal rows of fleshy tubercles which carry 2-3 short hairs and 1 or 2 pores; when the caterpillar is touched these pores secrete a viscous fluid (Plate 51, Senaratne, 1986); its pupa is in a closely-woven cocoon, pinkish straw colour, in the fold of the leaf (Fig. 8).

Red slug  
(*Eterusia aedea*  
*cingala*)

18 (17)

- a The slimy, smooth bodied larva is yellowish green with a bluish tinge and measuring about 10 mm (Plate 17, Cranham, 1966).

Green Geletine Grub  
(*Narosa conspersa*)

- b The slimy, smooth bodied larva has a prominently bluish tinge; is round and grows up to 13 mm. (Plate 18, Cranham, 1966).

The Large Geletine  
Grub  
(*Belippa lalana*)

19 (14)

- a The mobile caterpillar carries its house/case about; only its head and thoracic legs protrude out while it is in motion; when disturbed the caterpillar withdraws into the house which then hangs on the leaf by a silk thread (Psychids).

20

b The elongated slender caterpillar is naked; has 3 pairs of small claw like thoracic legs near the head and two pairs of stumpy abdominal legs at the rear end making it necessary for it to move with a leach-like looping movement (Geometrids).

21

c A grotesquely formed caterpillar of variable colouration from very dark reddish brown to greyish-black tinged with green or mottled light and dark brown; grows up to 50 mm; when disturbed assumes a typical threatening attitude resting only on the 4 pairs of abdominal legs with the head and thorax raised up and curved back, and the 'tail' raised with the claspers erect; when still, resembles a crumpled dead leaf; damage seen as holes or parts of leaves eaten leaving only the midrib or whole branches stripped of leaves; may cause serious damage to nurseries and young tea (Plate 52, Senaratne, 1986).

Lobster caterpillar  
(*Stauropus alternus*)

20 (19) a The house/case is made up of small pieces of stems and bark of branches (Fig. 9).

Faggot worms  
(*Kotachalia doubledayi*  
*Clania cramerri*  
*Clania variegata*)

- b The house/case is made up of small particles of leaves (Figs. 10 and 11).

Bag worms  
(*Manatha albipes*,  
*Acanthopsyche*  
*subteralbata*,  
*Chaliodes vitrea*)

- 21 (19) a When disturbed the ashy-brown caterpillar stiffens and stands up erect at an angle to the branch on which it gets a foothold using the rear legs or hang down from leaves; measures up to 50 mm when full grown. Damage is seen as holes on the lamina or parts of leaves eaten up leaving only the midrib or twigs stripped of leaves (Plate 45, Senaratne, 1986).

Twig caterpillar  
(*Ectropis bhurmitra*)

- b When disturbed the dark brown caterpillar stretches out on the branch and lies motionless; measures up to 75 mm when full grown and has a wrinkled appearance; the colouration is variable from greenish brown in early stages to grey or dull brown in the older larvae with a wrinkled warty appearance on the skin, damage as in 21a, (Plate 23, Cranham, 1966).

Looper caterpillar  
(*Buzura strigaria* =  
*Biston suppressaria*)

22 (11) a Two or three longitudinal corky lines on either side of the midrib; leaves do not curl up as in yellow mite attack, but tend to be rather puckered, hardened and deformed. Attacks only on young and mature tea recovering from prune in the high and mid country (Plate 57, Senaratne, 1986).

Thrips

b Damage seen as a winding, white band or a thick line which is really a mine underneath the cuticle on upper surface of leaf; seen both in nursery and new clearings (Fig. 12).

Tea Leaf Miner  
(*Melanagromyza theae*)

c No damage as above, but different colourations noticed in the nursery as well as in mature tea especially in dry weather.

23

23 (22) a Leaf laminae have different colourations without exhibiting the presence of any insects or damage to the leaf, but yield is reduced.

24

b Black coating of sooty mould on upper surface of mature foliage.

25

- c White mealy or filamentous masses adhering to bases of leaves and sometimes on the axil of the leaf and twigs; no visible damage to leaf laminae; is a very occasional pest; similar situation can be observed on rooted cuttings and young plants in the nursery.

**Mealy Bug**

- 24 (23) a A bronze colouration seen from far; when carefully examined globular and tiny reddish particles seen mostly on upper surface of mature leaves; when the thumb is pressed on such red particles it is spotted with pin dot red marks; in addition, white scale like minute particles are also seen scattered all over; out-breaks in dry weather; but not necessarily accompanied by subsequent defoliation (Plate 42, Senaratne, 1986).

**Red Spider Mite**  
(*Oligonychus coffeae*)

- b** A bronze colouration as in 24a; but the spot test does not answer; the very minute organisms found on the under surface of leaves can be seen only with a hand lens while the scale like particles can be seen with the naked eye as dust particles, not all over, at the initial stages, but aggregated near the base of the leaf, near the midrib and at the edge of the leaf; leaf base and other feeding sites appear scorched (Plate 43, Senaratne, 1986); defoliation is very common even during dry weather as well as with the first showers of rain that follow.

**Scarlet Mite**  
(*Brevipalpus californicus*)

- c** Violet colouration from far and near; very minute white specks on both sides of the leaf, require a hand lens to be seen clearly. Microscopic examination necessary to see the minute organisms; outbreaks in dry weather, but less common than in 24a or 24b.

**Purple Mite**  
(*Calacarus carinatus*)

25 (23) a Small, flat, oval shaped brownish scale like structures adhering to tender green stems and to the under surface of leaves; more concentrated near the leaf stalk and midrib; associated with sooty mould growing on honey dew ejected by these organisms and falling on the lower leaves (Plate 24, Cranham, 1966).

Green Bug  
(*Coccus viridis*)

b Prominently visible, oval but strongly domed, thereby appearing as hemispherical structures adhering to the stem and leaf surface, scattered all over, but more concentrated near the leaf margin and on the stem associated with sooty mould like in 25a (Fig. 22, Cranham, 1966).

Brown Bug  
(*Saissetia coffeae*)

c Sooty mould on mature leaves is due to honey dew secreted by organisms living on the flush and tender parts of the shoot above; the organisms in the flush are small oval shaped black organisms concentrated on the under side of tender leaves and shoots.

Tea Aphid - 7b

26	(3)	a	Problem seen as death of branches, death of whole plants or branch breakage at anytime, irrespective of pruning.	27
		b	Problem encountered at or soon after prune.	38
27	(26)	a	Whole bush or young plant yellowing/wilting/scorching/defoliating and may result in death.	28
		b	Single branches die during dry weather; symptoms seen in the S.W. quarter.	36
		c	Branches when bent, break; branch breakage seen in both immature and mature tea.	37
28	(27)	a	Immature plants especially in the nursery or in the 1st/2nd year from planting in the field affected.	29
		b	Mature plants, that is after the 1st cycle affected.	35
29	(28)	a	Stem damaged either at the collar or a few inches above in young plants.	30
		b	Stem bark intact and no other visible damage	33

- 30 (29) a Stem damage in the form of a hole about 5 mm in diameter a few centimeters above the collar; always associated with reddish pink frass (excreta) in the form of large pellets on the ground below; if the affected stem is split open it reveals a large gallery accommodating a dark reddish caterpillar which reaches 50 mm when fully grown, or a chestnut brown pupa; occurs at mid and low elevations especially noticeable in new clearings (Plate 21, Cranham, 1966)

Red borer  
(*Zeuzera coffeae*)

- b Stem damage in the form of damage to the bark and may result in ring barking.

31

- 31 (30) a Feeding marks in the stem resulting in girdling the base of the stem of the very young plants or rooted cuttings in the nursery. Stem girdling often associated with damage to lower-most leaves and associated with a dark brown caterpillar that hides in the soil during the day and feed in the night.

Cut worm  
(*Agrotis (Euxoa) segetum*)  
(*Agrotis suffusa*)

- b Tender shoots of very young plants of nurseries and new clearings bitten off; sometimes the main stem about an inch above ground level cut through; felled shoots may be dragged inside burrows in the soil at the base of the plant; such "plugged" burrows accommodate large blackish brown insects 40-50 mm long (Fig. 13).

Crickets

(*Brachytrupes portentotus*)

- c Damage similar to 31a, but in association with deep planting. 32

32 (31)

- a Young tea plants associated with and showing effects of deep planting; moribund or rotted collar has been eaten up causing callus formation at the edge of damaged bark; wound surface rugged, roots mostly intact; "C" shaped grubs in the planting hole (Plate 49, Senaratne, 1986).

White Grub

(*Microtrichia costata*)

- b Young tea plants associated with deep planting, wound surface is smooth and the damage is not confined to the bark, but the stem wood is eaten into and mostly accompanied by root damage and root roots appear to be damaged from distal ends, and appear sharpened as if passed through a pencil sharpener, no callus tissue like in 32a.

Scavenging Termite

(*Odontotermes horni*)

(*Odontotermes redemanni*)

(*Hypotermes obscuriceps*)

(*Hospitalitermes monoceros*)



Fig. 8 – Pupal case of Red slug inside a leaf-fold



Fig. 9 – Faggot worms of different species



Fig. 10 – Bag worms of different species



*Fig. 11 – Bag worm larvae and pupae (hanging down on threads)*



*Fig. 12 – Damage symptoms of Tea Leaf Miner*



*Fig. 13 – Tea Cricket*

- 33 (29) a All smaller roots bitten off without damage to the collar or only feeder roots bitten off and may or may not be associated with ring barking and callusing, but not in association with deep planting; seen at mid and high elevations, mostly in the latter half of the year; rarely in the low country; "C" shaped grubs in the planting hole (Senaratne, 1986).

White Grub  
(*Holotrichia disparilis*)

- b Similar damage in the low country

(*Anomala superflua*)

- c Roots damaged but not in association with "C" shaped grubs or collar damage.

34

- 34 (33) a Roots intact but with nodules.

Nematodes  
(Please refer to  
the TRI)

- b Roots intact, may or may not have colourations which when present may indicate root diseases.

Pathological conditions  
(Please refer to the  
TRI)

- 35 (28) a Mature bushes dying; affected bushes have some roots bitten off; soil excavated from underneath the bush, thus exposing roots to desiccation; dark brown ants associated with the affected bushes; damage occurring in patches roughly resembles lightening effect. Plant death is more due to root desiccation than to ant feeding.

Burrowing ants  
(*Myrmecaria brunii*)

- b Roots not damaged as in 35a, and no excavation of soil; at first a few bushes wilt and die suddenly, then surrounding bushes die similarly until a patch of tea bushes die and then the spread ceases; the affected bushes may have roots exhibiting dark brown circles and narrow long streaks; the bushes in the peripheral area may die back from the top; pathological tests may prove negative.

Lightening damage

- 36 (27) a Symptoms seen in the south-west quarter; affected branch when pruned out exposes galleries from which dirty white and brown coloured, soft bodied organisms ooze out; occupied galleries appear as clean chambers and extend down in the stem but stop at the collar or just below the collar (the abandoned upper parts of the galleries lying in the dead stem above may have been taken over by the scavengers and filled with earth); commonly occurring from sea level to 900 m (3000 ft) elevation; symptoms may be found on scattered bushes but a large population of the bush stand may be infested (Vitarana, 1986).

Low country Live-wood  
Termites

1. *Glyptotermes dilatatus*
2. *Neotermis greeni*

- b Symptoms seen in the south-west quarter but above 900 m (3000 ft) elevation and mostly in Maskeliya, Dimbula and Dickoya districts; affected branches when pruned expose hollow stems with earth like faecal matter filling up the hollow stems which has smooth ridges projecting into the hollow; adventitious roots from the gallery walls grow into the lumen; earth like material is not in association with scavenging termites; the galleries extend down beyond the collar into the roots and reach the ends of roots; off white and brown soft bodied organisms may inhabit the hollowed stems; affected bushes are found in groups of 10-50 bushes in a patch (Plate 29, Senaratne, 1986).

Up country Live-wood  
Termite

(*Postelectrotermes militaris*)

- 37 (27) a Branches snap with movement of pluckers or any other disturbance like strong wind; or breakage may occur at the base of the main stem of very immature plants or in the branches of mature plants; breakage is associated with a hole of 1 mm diameter on the stem and the broken end of the stem has a grooved appearance; when such a stem is split vertically tiny bore holes can be seen scattered on the split surface; very small whitish immobile and black and brown mobile organisms can be seen inside groove like galleries; at the time of the breakage the branch is not wilted, but it will be scorched later on; a purple colouration of the stem tissue is in association with the galleries (Senaratne, 1986)

Shot hole borer  
(*Xyleborus fornicatus*)

- b Fresh looking green branches break due to wind effect at points of blister blight attack on the stem.

Pathological condition

- 38 (26) a Problem seen as holes on the prune cuts may or may not be associated with decayed tissue surrounding the hole. 39
- b Problem seen as bushes not recovering from prune. 41
- 39 (38) a Holes on the prune cuts of young stems not more than 1 mm diameter and when horizontal grooves are exposed they measure 1 mm across; such holes and grooves or galleries are associated with purple colouration in the adjoining stem tissue; when the prune cut is on an old stem the holes and galleries are bigger and associated with dead/decayed tissue.

Shot hole borer  
(*Xyleborus fornicatus*)

- b Holes/cavities on the prune cut of young stems always more than 1 mm diameter and of varying sizes. No colouration associated with cavities. The symptoms are exposed when older prune cuts are shaven off. 40
- 40 (39) a Damage observed in the south west quarter from sea level up to 1050 m (3500 ft) elevation as described in 36 a.

Low Country Live-wood  
termites

- b Damage observed in the south-west quarter above 900 m (3000 ft) elevation in the up country as described in 36 b.

Up Country Live-wood  
termites

- 41 (38) a Lung branches have died back with no new growth of the bush and it appears like a dead stump; when cut across a honey comb of galleries harbouring organisms described in 36a spill out.

Low Country Live-wood  
termites

- b Lungs may not die but the bush may not recover properly and remain a passenger and die prematurely.

42

- 42 (41) a Severe wood rot accumulation and secondary damage by way of accumulation of soil in cavities in dead wood areas attacked by scavenging termites; dead wood accumulation may have been due to negligence at agricultural practices occurring repeatedly over several cycles.

Please improve standard  
of agricultural practices

- b No apparent debilitating factor like dead wood and wood rot accumulation; not accompanied by root damage.

Seek TRI expert  
advice immediately

- 43 (4) a Tent shaped earthen structures made around the growing cuttings; usually, enclosing whole plants and arresting their growth; when the structures are broken they are reconstructed over-night; a tiny brown ant in association; occasionally seen at low and mid elevations.

Nursery Ants  
(*Crematogaster* sp.)

- b The earthen structures are not tent like and they do not enclose the whole plant; plant parts covered by earth may be eaten up in parts; problem is seen when nurseries are located in uncleaned ground; some plants without exhibiting earthen structures may die solely due to root damage, especially during dry weather.

Scavenging termites  
(*Coptotermes ceylonicus*)  
(*Odontotermes horni*)  
(*O. redemanni*)  
(*Microcerotermes* sp.)  
(*Hypotermes obscuriceps*)  
(*Hospitalitermes monoceros*)

- 44 (4) a No damage to aerial parts, but weakened/wilted/dead plants, when uprooted, exhibit root damage like in 32 b.

Scavenging termite  
*(Odontotermes horni)*  
*(Coptotermes ceylonicus)*

- b No damage to aerial parts nor to roots excepting for the fact that roots are dead and appear blackish; not associated with White ants/White grubs/mealy bugs/scavenging termites.

Physiological condition due to poor drainage and not due to a pest.

## INDEX

### SCIENTIFIC NAME OF PEST

(In the order of appearance in the Key)	Identifying No.	Flowing Nos.
1. <i>GRACILARIA THEIVORA</i> <i>WALSINGHAM</i> = <i>CALOPTILIA THEIVORA</i> <i>WALSINGHAM</i>	6 (5) a	5, 1
2. <i>HOMONA COFFEARIA</i> NIETNER	6 (5) b	5, 1

	Identifying No.	Flowing Nos.
3. <i>HEMITARSONEMUS</i> <i>LATUS</i> BANKS	7 (5) a	5, 1
4. <i>TOXOPTERA</i> <i>AURANTII</i> Boyer de Fonseca	7 (5) b/25 (23) c	5, 1
5. (Jassid)	7 (5) c	5, 1
6. <i>OECOPHYLLA SMARAGDINA</i> FABRICIUS	9 (8) b	8, 2, 1
7. <i>CREMATOGASTER DORHNI</i> MAYR	9 (8) c	8, 2, 1
8. <i>SPODOPTERA LITURA</i> (FABRICIUS)	10 (8) a	8, 2, 1
9. <i>PIESMOPODA RUFIMARGI-</i> <i>NELLA</i> HAMPSON	12 (11) c	11, 10, 8, 2, 1
10. <i>ORASEMA</i> SP	13 (12) a	12, 11, 10, 8, 2, 1
11. <i>LYGUS VIRIDANUS</i> MOTSCHULSKY	13 (12) b	12, 11, 10, 8, 2, 1
12. <i>HELOPELTIS</i> SP	13 (12) c	12, 11, 10, 8, 2, 1

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13.	<i>MYLLOCERUS CURVI-CORNIS</i> FABRICIUS	14 (12) c	12,11,10,8,2,1
14.	<i>LEPROSUS</i> SPP		
15.	<i>DARNA NARARIA</i> formerly = <i>MACROPLECTRA</i> <i>NARARIA</i> (MOORE)	16 (15) a	15,14,12,10,8,2,1
16.	<i>PARASA LEPIDA</i> CRAMER	16 (15) b	15,14,12,10,8,1
17.	<i>HINDOTHOSEA CERVINA</i> formerly = <i>THOSEA CERVINA</i> MOORE	16 (15) c	15,14,12,10,8,2,1
18.	<i>ETERUSIA AEDEA</i> <i>CINGALA</i> MOORE	17 (15) a	15,14,12,10,8,2,1
19.	<i>NAROSA CONSPERSA</i> WALKER	18 (17) a	17,15,14,12,10, 8, 2, 1
20.	<i>BELIPPA LALEANA</i> MOORE	18 (17) b	17,15,14,12,10, 8, 2, 1
21.	<i>STAUROPUS ALTERNUS</i> WALKER	19 (14) c	14,12,10,8,2,1

	Identifying No.	Flowing Nos.
22. <i>KOTOCHALIA DOUBLE-DAYI</i> WESTWOOD, <i>CLANIA CRAMERII</i> WESTWOOD, <i>CLANIA VARIEGATA</i> SNELL	20 (19) a	19,14,12,10, 8, 2, 1
23. <i>MANATHA ALBIPES</i> MOORE, <i>ACANTHOPSYCHE SUBTERAL-BATA</i> HAMPSON, <i>CHALIODES VITREA</i> HAMPSON	20 (19) b	19,14,12,10, 8, 2, 1
24. <i>ECTROPIS BHURMITRA</i> WALKER = <i>BOARMIA BHURMITRA</i> WLK	21 (19) a	19,14,12,10, 8, 2, 1
25. <i>BUZURA STRIGARIA</i> MOORE = <i>BISTON SUPPRESSARIA</i>	21 (19) b	19,14,12,10, 8, 2, 1
26. Thrips	22 (11) a	11,10,8,2,1
27. <i>MELANAGROMYZA THEAE</i> de MEJERE	22 (11) b	11,10,8,2,1
28. Mealy bugs	23 (22) c	22,11,10,8, 2, 1

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29.	<i>OLIGONYCHUS COFFEAE</i> NIETNER	24 (23) a	23,22,11,10, 8, 2, 1
30.	<i>BREVIPALPUS CALI- FORNICUS</i> BANKS	24 (23) b	23,22,11,10, 8, 2, 1
31.	<i>CALACARUS CARINATUS</i> GREEN	24 (23) c	23,22,11,10, 8, 2, 1
32.	<i>COCCUS VIRIDIS</i> GREEN	25 (23) a	23,22,11,10, 8, 2, 1
33.	<i>SAISSETIA COFFEAE</i> WALKER	25 (23) b	23,22,11,10, 8, 2, 1
34.	<i>ZEUZERA COFFEAE</i> NIETNER	30 (29) a	29,28,27,26, 3, 2, 1
35.	<i>AGROTIS (EUXOA) SEGETUM</i> SCHIFF	31 (30) a	30,29,28,27, 26, 3, 2, 1
	<i>AGROTIS SUFFUSA</i> HUBNER	31 (30) b	30,29,28,27, 26, 3, 2, 1
36.	<i>BRACHYTRUPES PORTEN- TOTUS</i> (LICHT.)	31 (30) b	30,29,28,27, 26, 3, 2, 1
37.	<i>MICROTRICHIA COS- TATA</i> WALKER	32 (31) a	31,30,29,28, 27,26, 3, 2, 1

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38. <i>ODONTOTERMES REDE-</i> <i>MANII</i> WASMANN	32 (31) b	31,30,29,28, 27,26, 3, 2, 1
<i>ODONTOTERMES HORNI</i> WASMANN		
<i>COPTOTERMES CEYLONI-</i> <i>CUS</i> HOLMGREN	43 (4) a	4, 3, 2, 1
<i>HOSPITALITERMES MONO-</i> <i>CEROS</i> KOENIG	44 (4) a	4, 3, 2, 1
<i>HYPOTERMES OBSCURI-</i> <i>CEPS</i>		
39. <i>HOLOTRICHIA DISPARILIS</i> ARROW	33 (29) a	29,28,27,26, 3, 2, 1
40. <i>ANOMALA SUPERFLUA</i> ARROW	33 (29) b	29,28,27,26, 3, 2, 1
41. <i>MYRMECARIA BRUNEI</i>	32 (28) a	28,27,26,3,2,1
42. <i>GLYPTOTERMES DILA-</i> <i>TATUS</i> BUGNION & POPOFF	41 (38) a	38,26,3,2,1
<i>NEOTERMES GREENI</i>	36 (27) a	27,26,3,2,1
<i>DESNEUX</i>	40 (39) a	39,38,26,3,2,1

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43.	<i>POSTELECTROTERMES</i>	36 (27) b	27,26,3,2,1
	<i>MILITARIS</i> DESNEUX	40 (39) b	39,38,26,3,2,1
44.	<i>XYLEBORUS FORNICATUS</i>	37 (27) a	27,26,3,2,1
	EICHHOFF	39 (38) a	38,26,3,2,1
45.	<i>CREMATOGASTER</i> SPP	43 (4) a	4, 3, 2, 1

- CATERPILLAR** - The 2nd stage of development in the life cycle of a holometabolous insect is an eruciform larva which is a feeding stage.
- CLASPER** - Slender curved appendages borne on the terminal segment of the abdomen of an insect.
- CORRODED FLUSH-** The saliva of lygus bug contains a toxin which causes the death of cells around a feeding puncture which shows up as brown necrotic spot on the flush as the leaves grow and expand; the old feeding punctures tend to become small holes and the leaves become rugged and deformed.
- COCOON** - A silken case inside which the pupa (pupal stage) is formed.
- COLLAR** - The basal part of the frame of a tea bush that is closest to the ground surface.
- CORKY TISSUES** - Non living tissue which is protective in function because, its cell walls are highly impervious to water.
- CUTICLE** - Is the waxy, outer layer of leaf tissue that functions as a protective layer.

**EARTHEN  
STRUCTURE**

- Structures made up of soil kneaded with saliva of termites and constructed in the form of runways, earthen caps, earth blocks filling cavities on stems which termites feed upon.

**ECOLOGY**

- The study of an organism in relation to its environment.

**ECO-SYSTEM**

- A unit of environment comprised of plants, animals and physical factors all of which influence each other.

**ECO-TAXONOMIC  
KEY**

- A set of systematically arranged statements leading to classification of organisms in a given eco-system based on ecology of such organisms.

**FEEDER ROOTS**

- The terminal parts of lateral roots which are involved in the function of absorbing water and minerals from soil spaces.

**FLUSH**

- The foliage which is harvested as crop from a tea bush which includes the terminal bud and two or three leaves below.

**GALLERY**

- A tunnel made by a wood boring organism in plant tissue for purposes of feeding and living.

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- GIRDLING (Stem)** - Removal of a band of outer tissue from the stem horizontally; this is caused either manually as in ring barking of shade trees or by insect pests feeding on the bark; callus tissue appear as a lip at the edge of the damaged bark.
- GRUB** - A legless (abdominal legs absent) scarabaeid form larva.
- HONEYDEW** - Liquid discharged from the rectum of sap-sucking insects of order Homoptera.
- LAMINA**  
(pl Laminae) - That part of the leaf beyond the leaf stalk.
- LEAF STALK**  
(Petiole) - The narrow stem like base of the leaf, which joins the leaf lamina to stem.
- LARVA (pl Larvae)** - The immature stage between egg and pupa (or nymph) of an insect; also the six legged first instar of mites.
- MAINTENANCE FOLIAGE** - The leaf that is retained on the bush without being plucked as crop.
- MITES** - Minute organisms of roughly oval shaped body divisible into two parts, head and body and with appendages arranged in two groups, two pairs posteriorly and the others anteriorly.

- NECROTIC SPOTS** - Dead leaf tissue surrounding a damaged spot caused by sap sucking insects, e.g. Tea Mosquito bug.
- NODULES** - Bead like outgrowth of root cortex, caused by pathogenic organism.
- NURSERY CUTTING** - The unit of propagation of tea plants by vegetative method consisting of a portion of stem, leaf and included axillary bud.
- PARASITE** - An organism totally dependent and living at the expense of another organism.
- PLUCKING TABLE** - The top layer of flush made into a flat plane from which pluckable shoots are recovered as tea crop.
- PRUNE** - Periodical cutting of the tea frame in order to invigorate the bush and also to lower the plucking table.
- PUPA (Pupal stage)** - The stage between the larva and the adult of an insect with complete metamorphosis.
- PUPAL COCOON** - See Cocoon.
- PUPATION** - Transformation of larva to pupa.

- RIM BARKING** - Removal of the stem bark in the form of a ring.
- RESTED TEA** - Tea that is out of plucking either after prune for obtaining cuttings or after a period of stress.
- RIM BLIGHT** - Scorching of edge of the leaf lamina, due to pest damage or toxicity.
- STALK** - See leaf stalk.
- SCALE LIKE** - Disk like, thin, flat structure adhering to a surface.
- SCIENTIFIC NAME** - Internationally recognized latinized name of a species or sub species. It consists of 3 parts; generic name, species name and the name of the describer of the species.
- SOOTY MOULD** - Black fungal growth on the surface of the leaf lamina usually caused by the deposit of honey dew ejected by Homopteran insects.
- TUBERCLE** - Small knob like or rounded protuberances on the body surface.
- TAXONOMY** - Systematic classification of members of a given community.
- VEIN** - Conducting tissue arising from either the leaf stalk or midrib of a leaf.