Ferrar, 1987

A Guide to the Breeding Habits and Immature Stages of Diptera Cyclorrhapha

(Part 1: text)

by

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curved slits (Teskey (1972) speculated on how these might be derived from those of *Calobata*).

Taeniaptera spp. (Fig. 48.17): 3 rings of tiny, elongate slit-like apertures forming roughly elliptical patterns.

Mimegralla (Figs 48.18, 48.19): 3 rings of tiny apertures, in *M. a. striatofasciata* like those of *Taeniaptera* but in *M. coeruleifrons* tracing more irregular patterns. In *M. a. striatofasciata* each ring is not quite joined, suggesting that its origin is a linear slit that has become bent almost double.

Rainieria (Fig. 48.20): tiny apertures arranged in long, thin lines meandering across the spiracular field, not distinguishable into distinct groupings and not exactly similar on the two opposing plates.

Calobatina (Fig. 48.21): 40 or more tiny apertures spread over a broad crescent of the plate, not arranged in any pattern.

Micropeza (Fig. 48.22): as illustrated by Müller (1957), three straight slits, two in line and one halfsideways; each slit is shown as having two parallel rows of apertures, and could possibly be analogous to the slit of *Taeniaptera* that consists of two rows of apertures separated by a central space.

Calycopteryx (Fig. 48.23): 3 elongate oval slits, set in a roughly radiating pattern.

Buttons always present, see Figs for positioning; in *Calycopteryx* button marked with radiating wrinkles (Fig. 48.23); in *Calobata* buttons on mesad rectangular extensions of the spiracular plates (Fig. 48.27). Interspiracular processes generally small and inconspicuous, except in *Calycopteryx* and to a lesser extent *Mimegralla a. striatofasciata.*

Anal plate round to oval, indented posterolaterally in *Compsobata univitta.* Tubercles not mentioned in most species, but two very fine tubercles, one above each spiracular plate, illustrated and described for *Compsobata univitta,* and a double tubercle shown on either side of the anal plate in *Micropeza.* In *Mimegralla a. striatofasciata* an apparently hinged flap usually covers the posterior part of the anal slit (Fig. 48.28), and a similar structure may also be present in *Taeniaptera annulata* (see Berg 1947).

Puparium

Dimensions and references in Table 48.1; colour shades of brown from amber to dark brown. Cylindrical in shape and fairly slender (Figs 48.30 to 48.32), somewhat compressed in *Mimegralla;* anterior end tapering abruptly, with slight dorsolateral compression to produce lateral ribs at least in *Compsobata, Calobatina* and *Rainieria;* posterior end sharply truncate with a distinct rim in Calobatinae, bluntly rounded in most Taeniapterinae and *Micropeza;* segments at both ends usually with many wrinkles. Anal plate round to oval; an unusual keel-shaped extension is illustrated by Brindle (1965a) (Fig. 48.29), but is not mentioned in the text; it is possible that this somehow relates to the flap over part of the anal slit of the larva, mentioned by Berg (1947) for *Mimegralla* and possibly also *Taeniaptera.* Other features as in 3rd instar larva, including protuberant, upturned hooks of larval posterior spiracles. In *Mimegralla a. striatofasciata* the larval posterior spiracles are situated towards the top of an oval, slightly concave area bounded by a very dark, thick rim of cuticle.

49. Family Milichiidae

(= Phyllomyzidae)

Scope and distribution

A moderately large family, found in all major zoogeographical regions. Some species that are "filth flies" are now almost cosmopolitan through human agency. Two subfamilies recognised: Milichiinae and Madizinae. A third subfamily Carninae was once also included, but is now recognised as a separate family Carnidae.

Economic importance

None specifically recorded, though some species with "filth fly" habits are potential vectors of faecal-borne diseases.

Biology

Larvae are saprophagous in organic matter in a variety of niches — in wet media such as rotting fish, snails, insect pupae, decaying vegetable matter and many types of dung, and dry media such as grain, ant and bird nest detritus, wood detritus and dry guano. Table 49.1 gives a general analysis of the breeding habits, and records are listed below in detail.

Subfamily Milichiinae

Enigmilichia dimorphica Deeming — bred from rotten yam tubers in Nigeria (Deeming 1981c).

Milichia argyratoides Collin — larvae in a seeping wound on a tree (in Nigeria) also infested by the ant *Crematogaster;* the fly larvae cover themselves with excreta, and are attended by the ants which feed on this excremental covering; the fly larvae wander about in the run of the ants, but do not live in the ant nests (Farquharson 1922).

Milichia ludens (Wahlberg) — scavenger in nests of the ant *Lasius fuliginosus* in Britain (Donisthorpe 1927; O'Toole 1978).

Milichia orientalis Malloch — reared in Guam (Pacific) from swiftlet guano consisting of dry insect fragments, and from a mixture of rodent food and rodent droppings (Bohart and Gressitt 1951); also reared in Hawaii from barley seed (Hardy and Delfinado 1980).

Milichia piscivora Malloch — larvae in dead fish in Australia (Colless and McAlpine 1970). I have [illegible]n adults flying around in enclosed pig pens in northern Queensland, Australia.

Milichia pubescens Becker — reared from latrines (Deeming and Báez 1985).

Milichiella argyrogaster (Perris) — from insect-riddled bark of a linden-wood post in Europe (Hennig 1937b).

Milichiella lacteipennis (Loew) — from manure heaps, stable manure and rotting cow-pea seeds in Fiji (Bezzi 1928); from decaying aquatic vegetation and from cow and horse dung on Guam, from chicken dung and other dung in Hawaii, and from guinea-pig dung in Samoa (Bohart and Gressitt 1951).

Milichiella sp. (possibly also *lacteipennis)* — ANIC specimen reared from soil and manure in stockyards in the far north of Western Australia (Wyndham).

Milichiella sp. — reared from soil on rotting wood in Australia (Colless and McAlpine 1970).

Pholeomyia comans Sabrosky — larvae in nest [illegible]e and exhausted fungus garden substrate in nests of the fungus-growing ant *Atta texana* in USA (Moser and Neff 1971).

Pholeomyia dampfi Sabrosky — larvae in bat dung deep in caves in Central America (Sabrosky 1959b).

Pholeomyia texensis Sabrosky — larvae in nests of the ant *Atta texana* in USA (Moser and Neff 1971); adults ride into the nest on fragments of leaf carried in by the ants (Waller 1980).

Subfamily Madizinae

Costalima myrmicola Sabrosky — in nest of the ant *Azteca* in a *Cecropia* tree trunk in Brazil (Sabrosky 1953).

Desmometopa — synopsis of world species published by Sabrosky (1983), who also listed various breeding records; these and other records are as follows:

D. ciliata Hendel — reared from African boxthorn berries in Australia (Nikitin 1964).

D. gressitti Sabrosky — from pawpaw (papaya) log (Sabrosky 1983).

D. inaurata Lamb — reared from chicken dung, rotting snails, and one larva found inside a *Drosophila* puparium in decaying *Cheirodendron* leaves, all in Hawaii (Hardy and Delfinado 1980); also from horse dung, various decaying fruits and berries (including some infested by other insects), and locust egg pods (records quoted by Sabrosky 1983).

D. interfrontalis Sabrosky — from a palm log, rotting lettuce, and rotting banana skins (Sabrosky 1983).

D. leptometopoides Sabrosky — reared from mud and debris in pools (Sabrosky 1983).

D. magnicornis Sabrosky — reared from cocoa pods (Sabrosky 1983).

D. melanderi Sabrosky — reared from *Opuntia* cacti (Sabrosky 1983).

D. meridionalis Sabrosky — reared from rotting jack-fruit (Sabrosky 1983).

D. m-nigrum (Zetterstedt) — reared from the plant *Campanula* (condition not specified) in Europe (Hennig 1937b), from rotting cow-pea seeds in Fiji (Bezzi 1928), from chicken dung, and from water in bracts of decaying inflorescences of *Heliconia* (Heliconiaceae) [this last record doubtful, probably refers to *D. tarsalis*] (Sabrosky 1983).

D. nearctica Sabrosky — reared from grass (Sabrosky 1983).

D. saguaro Sabrosky — reared from rotting saguaro cactus and from *Opuntia* cactus (Sabrosky 1983).

D. singaporensis Kertész — reared from cow dung, chicken dung, a dead cat, and a variety of rotting vegetable materials; records and details in Sabrosky (1983).

D. sordida (Fallén) — from withered leaves of *Ilex* in Europe (Hennig 1937b), from cow dung, and from grass silage (Sabrosky 1983). A record by O'Toole (1978) of this species phoretic on hive bees and consuming collected pollen presumably refers to adult flies.

D. tarsalis Loew — reared from decaying *Cereus* cactus (Ryckman and Ames 1953), from cow dung, and from decaying vegetation (Bohart and Gressitt 1951; see also Sabrosky 1983).

D. varipalpis Malloch — reared from septic tanks and sewage beds, insect culture media, fungus growing on dried sheep hearts, and a variety of rot-

	Rotting animal matter	Rotting plant matter	Dung	Wood debris	Tree wound	Dry debris including seeds	Ants' nests	Birds' nests
Subfamily Milichiinae								
Enigmilichia dimorphica		×						
Milichia argyratoides					×			
Milichia ludens							×	
Milichia orientalis						×		
Milichia piscivora	×							
Milichia pubescens			×					
Milichiella argyrogaster				×				
Milichiella lacteipennis		×	×					
Milichiella sp.			×	×				
Pholeomyia comans							×	
Pholeomyia dampfi			×					
Pholeomyia texensis							×	
Subfamily Madizinae								
Costalima myrmicola							×	
Desmometopa ciliata		×						
Desmometopa gressitti		?		?				
Desmometopa inaurata	×	×	×					
Desmometopa interfrontalis		×		?				
Desmometopa leptometopoides		×						
Desmometopa magnicornis		×						
Desmometopa melanderi		×						
Desmometopa meridionalis		×						
Desmometopa m-nigrum		×	×					
Desmometopa nearctica		×						
Desmometopa saguaro		×						
Desmometopa singaporensis	×	×	×					
Desmometopa sordida		×	×					
Desmometopa tarsalis		×	×					
Desmometopa varipalpis	?	×	×					
Leptometopa coquilletti			×					
Leptometopa latipes			×					×
Madiza britannica				×				
Madiza glabra			×					
Phyllomyza equitans							×	
Phyllomyza formicae							×	
Stomosis flava				×				

Table 49.1. Recorded breeding habits of Milichiidae: specific details and references in text.

ting vegetable substances; see Sabrosky (1983) for records and details.

Leptometopa coquilletti (Hendel) — reared from pit latrines in Sudan (Hennig 1956).

Leptometopa latipes (Meigen) — reared from cesspits in Europe and human dung in North America (Hennig 1937b), from barn-owl nests in USA (Ryckman 1953) and from birds' nests in Europe (Hennig 1937b).

Leptometopa sp. — puparium in calf pen, Manbulloo, Northern Territory of Australia (ANIC specimen).

Madiza britannica Hennig — reared from beech wood detritus in Britain (Perry and Stubbs 1978).

Madiza glabra Fallén — reared from pig dung in USA; adults also attracted to other dungs but not reared from them (Coffey 1966).

Phyllomyza equitans (Hendel) — scavengers in nests of the ant *Lasius fuliginosus* in Britain (Donisthorpe 1927, as *P. lasiae* and *Neophyllomyza fagicola;* O'Toole 1978).

Phyllomyza formicae Schmitz — scavengers in nests of the ants *Lasius fuliginosus* and *Formica rufa* in Britain (Donisthorpe 1927, as *P. formicae* and *P. donisthorpei;* O'Toole 1978).

Stomosis flava Sabrosky — reared from wet debris in a cavity in a tulip tree and from a cavity in a beech tree in USA (Teskey 1976).

In discussing the biology of Milichiidae mention must also be made of the unusual habits of some adults, recorded as soliciting regurgigated food from ants, feeding at the anuses of ants, and sucking juices from the prey of robber flies (Asilidae), predacious Heteroptera and spiders, while the predator is still feeding. References on associations with spiders are reviewed by Robinson and Robinson (1977) and Sivinski and Stowe (1980). In Australia McMillan (1975) recorded such an association carried a stage further when he observed *Desmometopa* sp. cleaning the mouth regions of *Araneus* spiders, with the acquiescence of the spiders that spread their chelicerae to permit the operation; the flies also fed at the anuses of the spiders whenever they defaecated. No known breeding habits are associated with any of these adult feeding habits.

Species	3rd instar		Puparium		Lobes on III anterior spiracle	Reference
	Length	Width	Length	Width		
Subfamily Milichiinae						
Enigmilichia dimorphica			2.75	1.0	7	Deeming (1981c)
Milichia pubescens			4.2	1.5	9	Deeming & Báez (1985)
Milichiella lacteipennis	4		3	c.0.75		Bohart & Gressitt (1951)
Milichiella sp.			3.8	1.0	7	ANIC specimen
Pholeomyia comans	4.8-7.2	0.4-0.8	3-3.6	1-1.4	5-6	Moser & Neff (1971)
Subfamily Madizinae						
Desmometopa tarsalis or *D. varipalpis* (see text)	4		3	c.0.75	c.8	Bohart & Gressitt (1951)
— —	5-8	0.4-0.5			9-10	Zimin (1948)
Leptometopa coquilletti	c.6.2	c.0.8			7	Hennig (1956)
? *Leptometopa latipes*					12-13	Hennig (1956)
Leptometopa sp.			3.5	0.8		ANIC specimen
Phyllomyza formicae			3.1	1.0		Hennig (1937b)
Phyllomyza securicornis			3.5	1.15		Hennig (1937b)

Table 49.2. Dimensions of immature stages (mm) and numbers of lobes on 3rd instar anterior spiracle of Milichiidae.

Immature stages

Despite many breeding records noted above there are very few descriptions of immature stages of Milichiidae.

Egg

Undescribed, except that Sturtevant (1926) noted that the egg of *Desmometopa m-nigrum* possesses four long, slender filaments anteriorly.

1st and 2nd instars

Undescribed.

3rd instar

Dimensions and references in Table 49.2. Slender, elongate body (Fig. 49.1), tapering gradually forwards, more or less truncate posteriorly. Head bilobate, deeply so in *Leptometopa coquilletti*. Spined creeping welts noticeably protuberant, confined to ventral segmental borders though extending a short way laterally in *L. coquilletti*. Prothoracic segment with encircling spine collar in *?Leptometopa latipes;* similar collar in *Pholeomyia* also extending over anteroventral part of mesothoracic segment; no such collar in *L. coquilletti*. Anal plate very protuberant, possibly acting like a pseudopodium. *Desmometopa* and *Leptometopa* with several small to large tubercles set on the posterior segment above the mountings of the posterior spiracles; *Pholeomyia* without such tubercles.

Cephalopharyngeal skeleton (Figs 49.2, 49.4) with elongate, slender, curved mouthhooks, posteroventral apodeme of which is usually quite pointed and sometimes curves backwards; dental sclerites present, triangular or thin and rod-like. In *Enigmilichia* and *L. coquilletti* mouthhooks articulate as normal with intermediate sclerite; in *Pholeomyia, Desmometopa* and *?Leptometopa latipes* there is an extra sclerite between the two, termed the intercalary sclerite by Moser and Neff (1971). Intermediate sclerite separate from pharyngeal, fairly robust, its two lateral pieces joined by a transverse bridge (Fig. 49.3), sometimes of elaborate shape (e.g. *?L. latipes:* Fig. 49.5). Parastomal bars, dorsal bridge and conspicuous ventral pharyngeal ridges present; ventral cornua broader and sometimes also longer than dorsal, without dorsal apodeme. Mouthhooks, intermediate sclerite and sometimes also dorsal bridge dark, pharyngeal sclerite pale.

Anterior spiracles (Figs 49.6 to 49.9) rosette-shaped in *Enigmilichia, Milichiella* and *Leptometopa coquilletti,* flatly fan-shaped in *Pholeomyia,* and with an elongate axis bearing long, finger-like lobes in *Desmometopa, Milichia* and *?Leptometopa latipes.* Numbers of lobes in Table 49.2.

Posterior spiracles borne on widely-separated, protuberant mountings (Figs 49.10 to 49.14); spiracles except in *?L. latipes* lacking a peritreme and not on a uniform plate, but each consisting of three projections set roughly at right angles to each other, each projection with a straight or slightly curved slit set at a characteristic angle (Figs 49.15 to 49.18); conspicuous interspiracular processes present.

Puparium

Dimensions and references in Table 49.2. Normal to elongate barrel-shape (Figs 49.19 to 49.22); tapered anterior end dorsoventrally compressed to produce more or less obvious lateral flanges. Larval posterior spiracles on protuberant mountings as in larva, the three 'fingers' of the spiracle pale buff-coloured and contrasting with the brown of the puparium (at least in ANIC specimens and *Desmometopa).* Larval anterior spiracles conspicuous in *Enigmilichia, Desmometopa, Milichia* and *Milichiella* (ANIC specimen), but obscure in *Leptometopa* (ANIC specimen) and *Phyllomyza* spp. Colour from yellowish-brown to dark reddish-brown.

50. Family Mormotomyiidae

Scope and distribution

Sole representative *Mormotomyia hirsuta* Austen, known only from a cave-like cleft in a large boulder on Ukazzi Hill, Kenya, Africa.

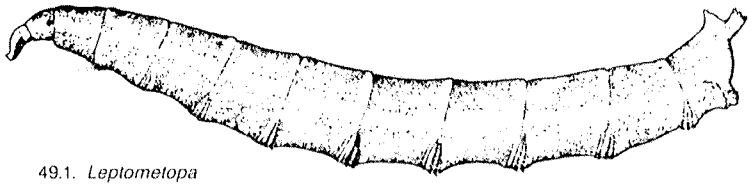
Economic importance

None.

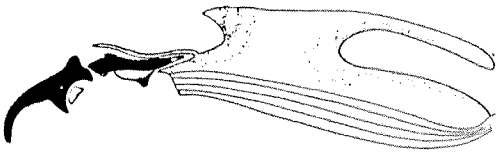
Notes on literature

Systematic position, biology and morphology of adult and some immature stages described by van Emden (1950b), on which paper the notes below are based.

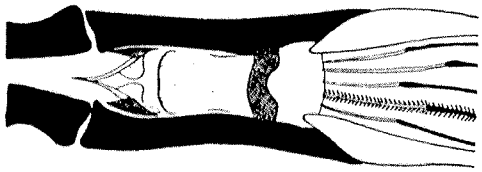
49. Milichiidae



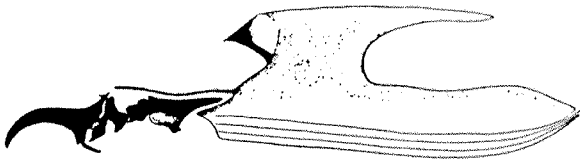
49.1. *Leptometopa coquilletti:* whole III (lateral).



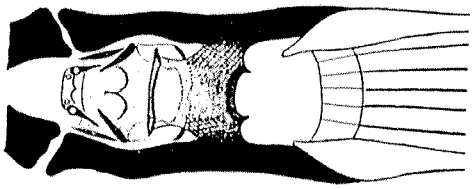
49.2. *Leptometopa coquilletti:* III, head skeleton.



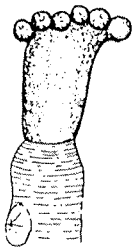
49.3. Same: intermediate sclerite of III head skeleton (ventral).



49.4. *Leptometopa ?latipes:* III, head skeleton.

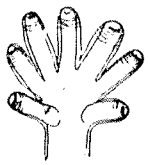


49.5. Same: intermediate sclerite of III head skeleton (ventral).



49.6. *Pholeomyia comans:* III, anterior spiracle.

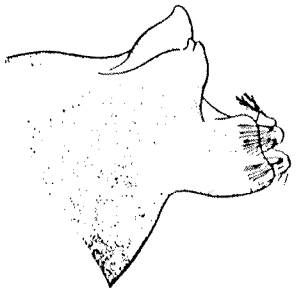
49.7. *Enigmilichia dimorphica:* III, ant. spiracle (from P).



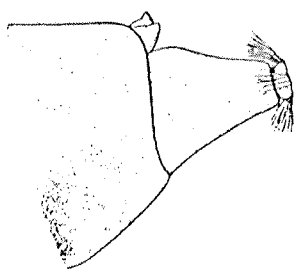
49.8. *Leptometopa coquilletti:* III, ant. spiracle.

49.9. *Leptometopa ?latipes:* III, anterior spiracle.

? Desmo

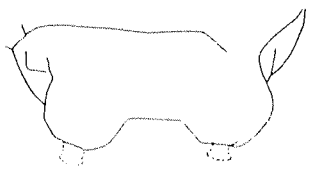


49.10. *Leptometopa coquilletti:* hind end of III (lateral).

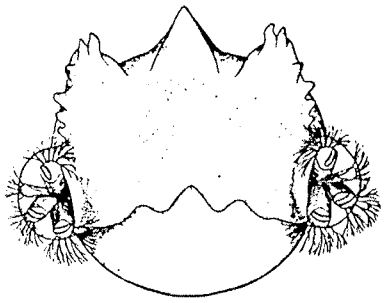


49.11. *Leptometopa ?latipes:* hind end of III (lateral).

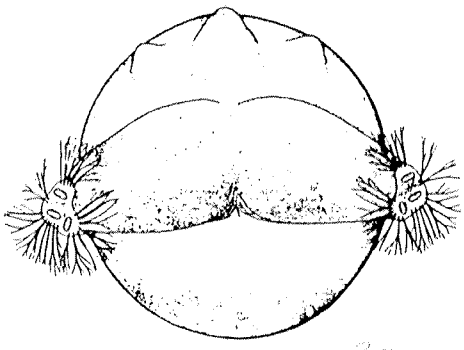
? Desmo



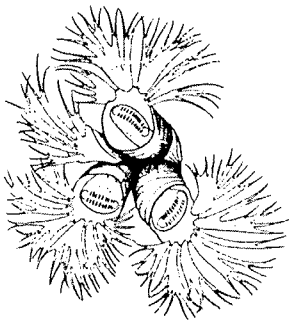
49.12. *Enigmilichia dimorphica:* hind end of P (dorsal).



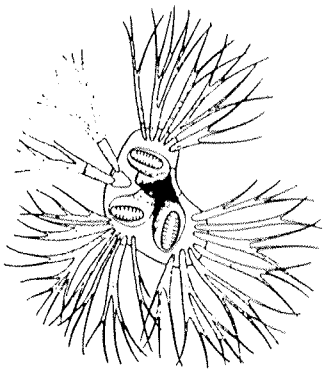
49.13. *Leptometopa coquilletti:* hind end of III (posterior).



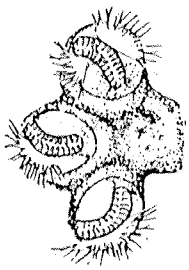
49.14. *Leptometopa ?latipes:* hind end of III (posterior).



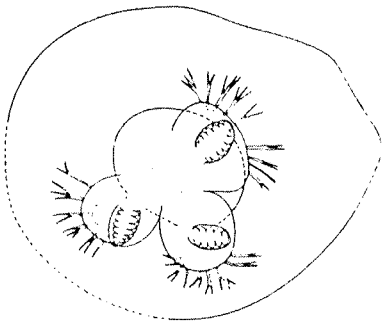
49.15. *Leptometopa coquilletti:* III, left posterior spiracle.



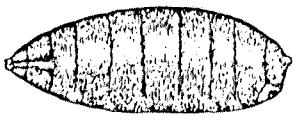
49.16. *Leptometopa ?latipes:* III, left posterior spiracle.



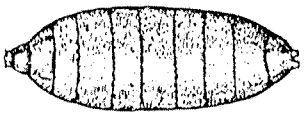
49.17. *Pholeomyia comans:* III, left post. spiracle.



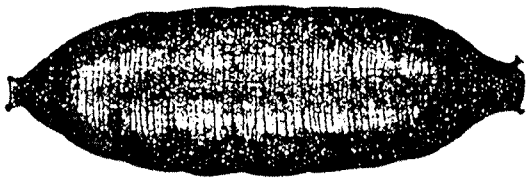
49.18. *Enigmilichia dimorphica:* III, right posterior spiracle (from P).



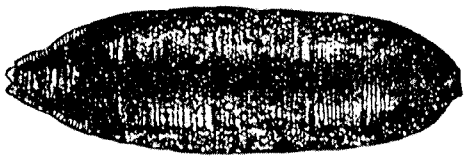
49.19. *Pholeomyia comans:* P (lateral).



49.20. Same: dorsal.



49.21. *Phyllomyza securicornis:* P.



49.22. *Phyllomyza formicae:* P.