

The systematic position
of *Thermocrates epischista* MEYRICK
(Lepidoptera : Tineidae)
and the biology of the Dryadaulinae

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Abstract

Thermocrates MEYRICK, 1936, a monobasic genus described from Japan, is shown to be a junior subjective synonym of *Dryadaula* MEYRICK, 1893, a genus most strongly represented in Australia and New Zealand. The constituent genera of the Dryadaulinae and their biologies are reviewed, including the extraordinary habit of gyratory dance of one species. The remarkable asymmetrical male genitalia of *Dryadaula epischista* (MEYRICK), typical of the subfamily, are described and illustrated.

Zusammenfassung

Es wird nachgewiesen, dass *Thermocrates* MEYRICK, 1936, eine aus Japan beschriebene monobasische Gattung, ein jüngerer subjektives Synonym von *Dryadaula* MEYRICK, 1893, einer vorwiegend in Australien und Neuseeland vertretenen Gattung, ist. Die Gattungen der Dryadaulinae und ihre Biologien werden besprochen, einschliesslich der eigentümlichen Tanzgewohnheit einer Art. Die bemerkenswerten asymmetrischen Genitalien von *Dryadaula epischista* (MEYRICK) werden als typisch für diese Unterfamilie beschrieben und abgebildet.

Background

MEYRICK (1936) erected the genus *Thermocrates* to accommodate a single species, *T. epischista* MEYRICK, 1936, based on a single specimen from Kyushu, Japan. The holotype of *T. epischista* lacks an abdomen and, until now, it has proved impossible to resolve satisfactorily its systematic position. MEYRICK, in his original description, placed *Thermocrates* close to *Erechthias* in the Lyonetiidae. MEYRICK's concept of the Lyonetiidae was broader than that of the present day, and *Erechthias* and many other genera placed there are now recognised as Tineidae. Lyonetiidae *sensu stricto* are considered to be Yponomeutoidea (KYRKI, 1984). *Erechthias* and its allies are currently considered a monophyletic subfamily, Erechthiinae, within the

Tineidae (ZIMMERMAN, 1978 ; ROBINSON, 1983 ; ROBINSON & NIELSEN, in prep.).

A second specimen of *Thermocrates epischista* has been reported and figured by MORIUTI (1982) but this lacks the abdomen and the hindwings and so does not help resolve the problem.

New material

I recently identified a third example of *T. epischista* among a collection of Microlepidoptera made in Hong Kong by Mrs Judith ROBINSON and presented to the British Museum (Natural History), abbreviated hereafter as "BMNH". The specimen was collected in April 1982 in an actinic light-trap designed specifically for Microlepidoptera (COMMON, 1986). The trap was operated on the window-sill of a first-floor flat in the Mid-Levels district of Hong Kong Island, adjacent to the tree-lined concrete trackway of the Peak Tram funicular railway. The trackway and its trees form a steep, damp gully in a landscape that is otherwise predominantly concrete ; considering the level of atmospheric pollution, there is a surprising amount of lichen and algae on the trees and trackway.

Examination of the third specimen of *T. epischista* showed it to match closely the holotype in all external features and to match also the figure of the second specimen by MORIUTI (1982). The specimen is a male and has characteristic broadly spatulate labial palpi ; it was obvious from external examination that the genitalia were strongly asymmetrical and dissection confirmed this. It also revealed marked modification of the terminal segmentation of the pregenital abdomen. Examination of the venation revealed that R1 in the forewing originated much closer to the base of R than in most Tineidae, A2 was weak or absent, and that one vein, either M3 or CuA2, was absent in the hindwing. This combination of characters places *T. epischista* firmly as a member of the genus *Dryadula*.

Dryadula and the Dryadulinae

BRADLEY (1966) erected the subfamily Dryadulinae to accommodate *Dryadula* and ZIMMERMAN (1978) added *Choropleca* to the group. Other Dryadulinae have been unrecognized as such and have been placed in other subfamilies of the Tineidae when originally described ; *Strophalinga* GOZMÁNY & VÁRI, 1973, was placed in the Nemapogoninae, and *Archimeessia* ZAGULAJEV, 1970, was placed in the Meessinae. Work in progress on the Australian Tineidae (ROBINSON & NIELSEN, in prep.) suggests that these genera may prove to be synonyms of *Dryadula* and that *Chorocosma* MEYRICK, 1893, may fall into the same category. Three further tineid genera,

Eschatotypa MEYRICK, *Eugennaea* MEYRICK and *Sagephora* MEYRICK, may also be referable to the Dryadaulinae. They are endemic to New Zealand and have superficially similar asymmetrical male genitalia (PHILPOTT, 1927a ; 1927b).

The distribution of *Dryadaula* is thus provisionally suggested to be world-wide, but the genus is represented particularly strongly in Australia and New Zealand.

Biology of the Dryadaulinae

Observations on the biology of the group are few. MORRISON (1968) has described the habits of *D. pactolia* MEYRICK in Britain where it is an introduced species. It inhabits cool, damp wine cellars and the bonded warehouses where Scotch whisky is stored to mature. MORRISON found larvae feeding in silk-lined tunnels in mats of the wine-cellar fungus *Rhacodium cellare* PERZ. ex WALL. growing on the floor of a bonded warehouse ; the larva, male and female genitalia, and venation of *D. pactolia* are illustrated in his paper.

ZIMMERMAN (1978) has provided a detailed description of two species of *Choropleca* (see above) and figured the head, venation and male and female genitalia. Details of the larva and pupa of *C. terpsichorella* (BUSCK) are also figured. Quoting from SWEZEY, he notes that although the larva of *terpsichorella* has been found among dead leaves and other parts of banana, sugar cane, pineapple, *Pandanus* and other plants, the precise food of the larva is unknown ; ZIMMERMAN suspects that it may feed on arthropod remains.

ZAGULAJEV (1970) found adults of *Archimeessia* flying at dusk near stumps of fallen and decaying trees. He found that first-instar larvae would, in the laboratory, mine in rotten wood beneath or very close to lichens ; second and subsequent instars built a flattened case and fed on the lichen.

In the Tai Po Kau Nature Reserve in Hong Kong I have collected a pair of an unnamed *Dryadaula* species *in copula* on a dead tree with considerable growth of lichen and fungi. As noted by MORRISON (1968) for *D. pactolia*, the copulatory posture of *Dryadaula* is conventional, despite the marked asymmetry of the male genitalia. In one respect, however, the biology of at least one dryadauline species is extraordinary : it dances.

Dancing Lepidoptera

In Hawaii *Choropleca terpsichorella* is known as "the dancing moth" (ZIMMERMAN, 1978 ; SATTLER, pers. comm.). The adult, which is predominantly creamy white with some brown and black at the forewing costa and apex,

performs a dance-like display, running in tight circles with a crab-like sideways gait. It is not certain whether this behaviour is peculiar to this species or is more widespread within the Dryadaulinae. K. R. TUCK, H. S. BARLOW, P. J. M. GREENSLADE and I have observed similar displays by an unidentified species of Momphidae in Sulawesi and Malaysia. This moth performs its dance on the upper and under-surfaces of leaves of a variety of plant species in rain forest, running in tight circles both clockwise and anticlockwise. TUCK (pers. comm.) has observed a display lasting fifteen minutes. As in the case of *Choropleca*, both sexes dance. The momphid is blue, black and white; silvery reflective scales on the legs are conspicuous during the dance. In Sulawesi the momphid and its dance are the model for, or mimic an identical display by a similarly coloured collembolan — *Lepidocyrtus* sp. (Entomobryidae) (det. Penelope GREENSLADE). In W. Malaysia I have observed a male example of *Callicerastis stagmatias* MEYRICK (Tineidae) performing a similar dance on a leaf: the coloration of this species is similar to that of the momphid. Somewhat similar gyrotory movements have also been observed in laboratory stock of *Opogona flavofasciata* (STAIN-TON) (Tineidae: Hieroxestinae), but these are performed for only a few seconds. PLANT (1980) has described a gyrotory dance in *Mompha nodicollis* FUCHS (Momphidae) in Britain.

The purpose of gyrotory dance in these moths is unknown. The performances are solo: no attraction of or intervention by other organisms (apart from the observers) has ever been noted. The behaviour is remarkably conspicuous and does not seem to be a response to the approach of the observer. It seems unlikely, therefore, that it is an attempt to deter or confuse predators. The generality of dance, at least in *Choropleca terpsichorella*, suggests that it is not a response to infection or parasitism.

Genital structure

Several attempts have been made to homologize the various components of the bizarre male genitalia of *Dryadaula*. The first, and possibly the most successful, was by PHILPOTT (1927b), who drew attention also to the similarities between the genitalia of *Dryadaula* and those of the endemic New Zealand genus *Sagephora*, the genitalia of which he had described in an earlier paper (PHILPOTT, 1927a). Other descriptions include those of MORRISON (1968), ZAGULAJEV (1970 — for *Archimeessia*) and ZIMMERMAN (1978 — for *Choropleca*). A definitive interpretation must await a detailed examination of a wide range of dryadauline species, and the nomenclature used below for *D. epischista* should be considered tentative.

The method used in the preparation of the genitalia of *D. epischista* requires brief explanation. All components within the ring formed by the vinculum and tegumen were dissected out, spread slightly, and mounted dorsoventrally. The same orientation was adopted for the remainder of the genital capsule with the eighth sternite and lateral sclerites.

I have assumed that the aedeagus is fused with the right valva; the "bridge" from the aedeagus to the left valva is derived from sclerotization of the diaphragma and could be referred to loosely as the juxta. The large lobed structure articulating with the left of the vinculum is directed posteriorly in life; it has been rotated ventrally and anteriorly in making the genitalia preparation. Although resembling a valva, this component has no apodemes and, apparently, no attached muscles. I take it to be the highly modified eighth sternite. However, the sinuate process which lies inside and against the eighth sternite has an apodemal base with attached muscles and I interpret this as the left valva. The figures are labelled accordingly and interpreted in the caption. The free sclerites either side of the vinculum-tegumen junction may be remnants of the seventh and/or eighth tergites which have otherwise been lost.

The generic diagnosis given here is abbreviated; a detailed diagnosis and full generic synonymy will be published by ROBINSON & NIELSEN (in prep.).

***Dryadaula* MEYRICK, 1893**

Dryadaula MEYRICK, 1893, *Proc. Linn. Soc. N.S.W.* 17 : 559. Type species : *Dryadaula glycinopa* MEYRICK, 1893, *ibidem* 17 : 559, by monotypy. [Australia].

Thermocrates MEYRICK, 1936, *Exot. Microlepid.* 4 : 620. Type species : *Thermocrates epischista* MEYRICK, 1936, *ibidem* 4 : 621, by monotypy. [Japan.] **Syn. n.**

DIAGNOSIS. Small moths, less than 20 mm in expanse; head entirely clothed with erect piliform scales; labial palpi spatulate, with lateral but not terminal bristles. Forewing venation complete; R1 arising close to base of R, A2 weak or absent. Hindwing with one vein (M3 or CuA1) absent; A3 not developed. Pregenital abdomen of male with terminal segmentation reduced and highly modified, usually asymmetrical. Male genitalia strongly asymmetrical, incorporating elements of eighth sternite; aedeagus fused with right valva; gnathos absent; uncus lobes elongate, supporting anal tube, usually with spicular setae at apex. Female ovipositor greatly shortened, thus not of typical tineid type; papillae anales short, rounded; apophyses posteriores short; eighth sternite hardly developed; apophyses anteriores rudimentary or absent. Larva with four ocellar lenses on either side of head; SD1 atypically long; tarsi elongate; derm spicular.

Dryadaula epischista (MEYRICK, 1936), comb. n.

Thermocrates epischista MEYRICK, 1936, *Exot. Microlepid.* 4 : 621.

Thermocrates epischista MEYRICK ; MORIUTI, 1982, *Moths Japan* 1 : 170, 2 : 187, pl. 233, fig. 2.

ADULT (Fig. 1). 7-8 mm. Head ochreous yellow ; labial palpi light yellow ; antennal flagellum irregularly alternated grey-brown and off-white. Forewing dull ochreous brown patterned with yellow-brown, yellow and white. Hindwing brownish grey with darker fringes.

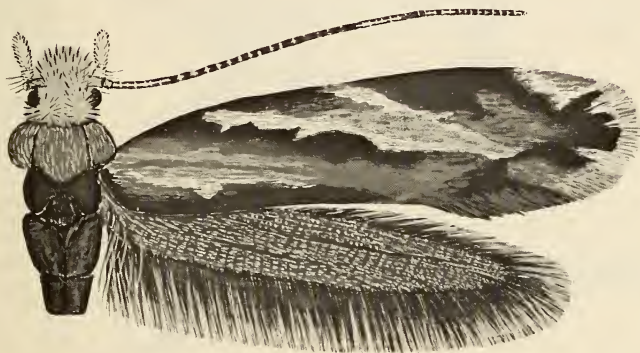


Fig. 1. *Dryadaula epischista* (MEYRICK), ♂, composite sketch from holotype and Hong Kong specimen.

PREGENITAL ABDOMEN (Fig. 2). Tergum I sclerotized in anterior half of "frame", fused with TII ; TIII to TVI rectangular to trapezoidal with strongly sclerotized anterior margins ; TVI only half length of preceding segments ; TVII and TVIII absent or represented by free sclerites either side of genitalia. Sternum II with very short, widely-spaced apodemes ; SIII to SVI broadly rectangular, SV and SVI slightly asymmetrical, SVI strongly sclerotized at anterior margin ; SVII asymmetrical, large, strongly sclerotized, forming a free lobe (pleural membrane is reflexed beneath it) overlying genital capsule in ventral view. SVIII incorporated into genital capsule.

MALE GENITALIA (Figs. 3, 4). Uncus elongate, supporting anal tube, slightly rugose, with single apical spine ; slightly asymmetrical and twisted to the left.

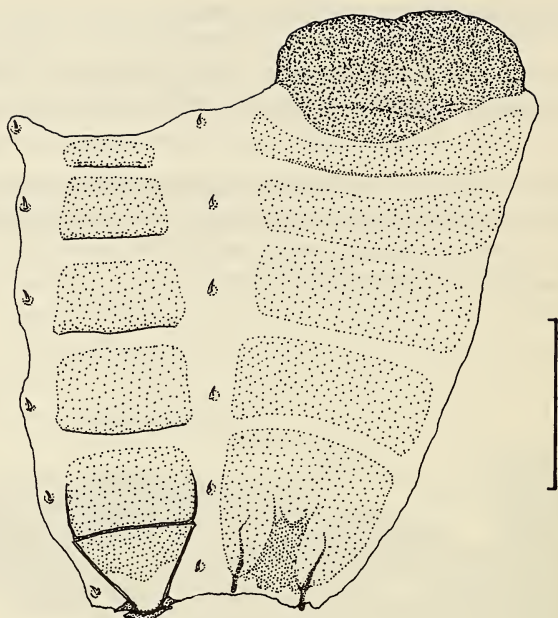


Fig. 2. *Dryadula epischista* (MEYRICK) : abdominal pelt. Note absence of tergites VII and VIII and sternite VIII. Scale line = 0.5 mm.

Tegumen twisted similarly, narrow, with broad, blunt internal lobe on right ; entirely fused with vinculum but strongly angled, particularly at left, at presumed junction. Gnathos absent. Vinculum shallow, with short triangular asymmetrical saccus with leftward-directed triangular apical process. Free sclerite (? remnant of TVII and/or TVIII — see above) either side of presumed point of fusion of vinculum and tegumen. Sternite VIII to left, articulated with vinculum, directed posteriorly at rest (turned antero-ventrally in preparation) ; rhomboidal, with pair of spinose processes on ventral margin and with spinose apex ; lateral margin with nodular process close to base articulating (at rest) with corner angle of vinculum-tegumen. Components within vinculum + tegumen markedly asymmetrical. Right valva broadly lanceolate ; internal surface strongly setose with short, rugose digitate process close to base ; base broadly and irregularly cup-shaped, without identifiable apodeme, nodular process on ventral surface articulating with vinculum ; left face of basal “cup” extended into a flange that is firmly fused with lateral wall of aedeagus. Aedeagus sinuate, with sharply pointed apex ; vesica without ornamentation. Juxta to left of aedeagus, irregularly quadrate, forming a “bridge” to left valva. Left valva slender, elongate, sinuate, with lobate

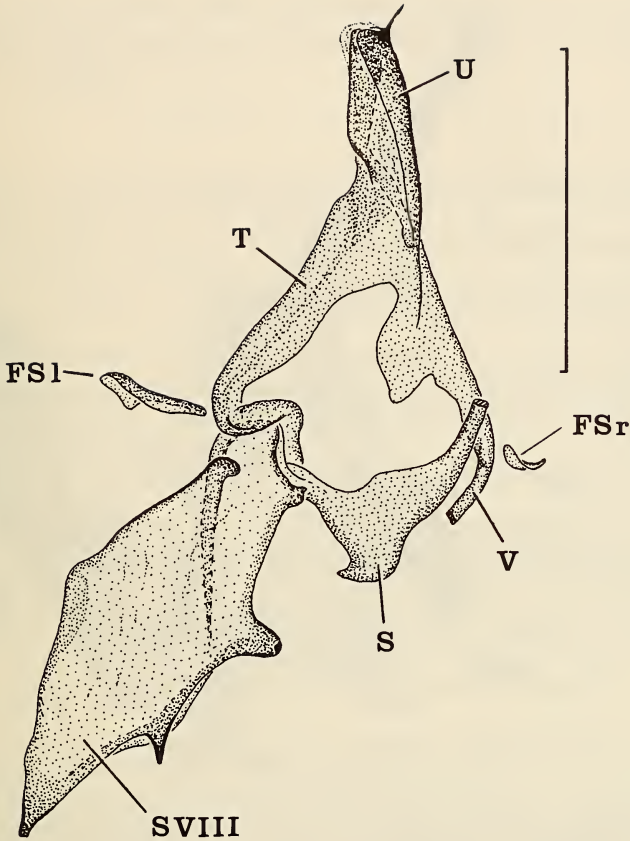


Fig. 3. *Dryadula epischista* (MEYRICK) : ♂ genitalia. Components within the ring formed by the vinculum and tegumen have been dissected out and are illustrated in fig. 4. Note that right side of vinculum was broken in dissection but is complete. FSl, FSr = free sclerites (left and right) ; SVIII = sternite VIII ; S = saccus ; T = tegumen ; U = uncus ; V = vinculum. Scale line = 0.5 mm.

process at one-half bearing spinose setae on dorsal surface ; base of valva with muscle insertion on ventral surface and with large radiating tendon (presumed) from dorsal surface.

FEMALE GENITALIA. Unknown.

MATERIAL EXAMINED.

Holotype ♂, JAPAN : Kyushu, Mozi, 2.vii.1934 (ISSIKI) (abdomen missing ; BMNH).

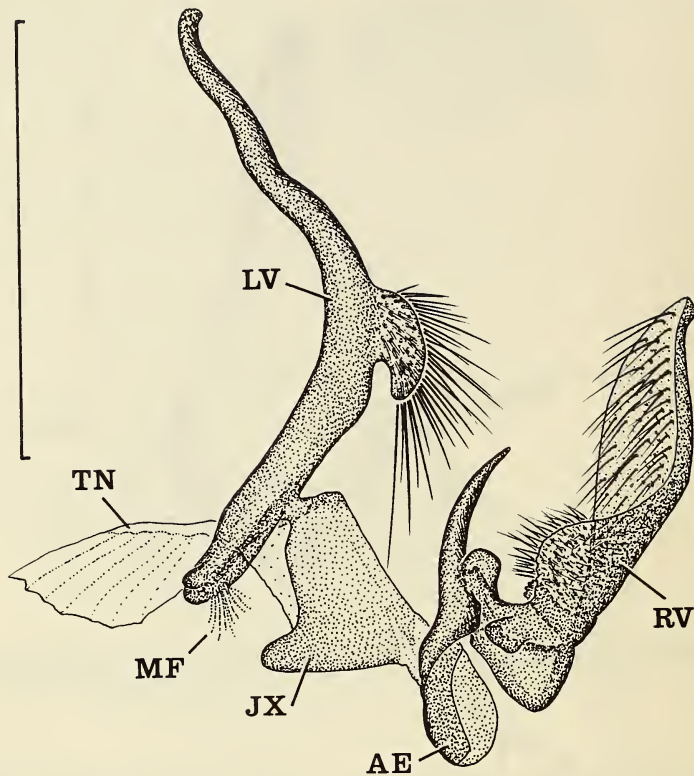


Fig. 4. *Dryadula epischista* (MEYRICK): ♂ genitalia. Components from within ring of vinculum + tegumen. AE = aedeagus; JX = juxta; LV = left valva; MF = muscle fibres of ventral muscle insertion; RV = right valva; TN = tendon from dorsal muscle insertion. Scale line = 0.5 mm.

1 ♂, HONG KONG I.: Mid-levels, 150 m, actinic trap, iv.1982 (Judith ROBINSON) (genitalia slide no. 10411; BMNH).

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