

**FRUIT FLIES (DIPTERA: TEPHRITIDAE) REARED FROM  
FRUITS OF *EXCOECARIA AGALLOCHA* (EUPHORBIACEAE)  
IN SINGAPORE MANGROVES**

**Cynthia S. C. Lee**

*ABSTRACT.* - Three fruit flies were reared from the mature seed capsules of *Excoecaria agallocha*, a mangrove tree. *Elleipsa quadrifasciata* Hardy 1970 previously known from the Philippines is newly recorded from Singapore and the male and female genitalia described. Descriptions are given for *Adrama magister*, new species, and *Hardyadrama excoecaria*, new genus and species.

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**INTRODUCTION**

The Tephritidae of Southeast Asia have been recently treated in two regional monographs (Hardy 1973, 1974) and some tribes have been given detailed revisions (Hardy 1983, 1986, 1988). Inevitably much remains to be done but in the Adramini treated by Hardy (1986) new taxa can be established with confidence.

Apart from pests of economically important crop plants, mostly species of *Dacus*, the biology of oriental Tephritidae is poorly known. Murphy (1990) reported two species, only provisionally identified, to be associated with the widespread mangrove tree *Excoecaria agallocha* L. (Euphorbiaceae). These and a third with similar habits are described here. Two of these, both in the tribe Adramini are described as new and for one of them a new genus is established. The latter seems to be one recognised and briefly described but not named by Hardy (1974), and this new genus *Hardyadrama* is therefore dedicated to him. Brief notes on the biology of these three species is also given but full treatment of the immature stages is postponed pending further study.

**MATERIAL AND METHODS**

All three species were initially collected as day-flying adults in Singapore mangroves without definite host association. During the course of a research project on pests of mangrove trees (Murphy, 1990) further material was later reared from larvae infesting fruits of *Excoecaria*. Pinned adults, some with associated puparial pelts were used in descriptive taxonomy. Alcohol material of immatures was also preserved but requires further study.

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For genitalia, detached abdomens were treated with 10% KOH and examined in phenol just liquified by 95% ethanol before processing to permanent Euparal preparations. Some female piercers were forcibly flattened to check details of serration. In males the periandrial structure is complex, assymetrical and partly membranous and its 3-dimensional structure difficult to interpret. Some material, after clearing with hot KOH was lightly stained with Chlorazol Black in 10% KOH (procedure modified after Carayon, 1969), washed in water and examined in Glycerol. These are preserved in microvials attached to the pinned specimens. Such preparations are essential to understanding the orientation and articulation of the aedeagal apodeme with the “wish-bone”-like hypandrium.

Nomenclature of chaetotaxy follows Colless & McAlpine (1970) and Hennig (1958). Nomenclature of genitalia structures follow Hardy (1974, 1986).

Holotypes and some paratypes are deposited in The Natural History Museum (NHM), London (formerly BMNH) other paratypes are in the Zoological Reference Collection (ZRC), National University of Singapore, the Bernice P. Bishop Museum (BPBM), Honolulu, Hawaii, the U. S. National Museum, Smithsonian Institute (USNM), Washington D.C., and the Queensland Department of Primary Industries (DPI), Brisbane, Australia.

Intact reared specimens were preferred for holotypes even though smaller and slightly teneral, but as far as possible, distributed series include feral material. Most of the dissected material is included in the ZRC series.

### ***Hardyadrama*, new genus**

Type-species - *Hardyadrama excoecariae*, new species

*Description.* - On external characters, a typical member of the tribe Adramini sensu Hardy (1986) in having reduced chaetotaxy of the head and thorax (Fig. 1); lacking sternopleural, propleural, ocellar, postocellar bristles. It fits near *Adrama* Walker by having all femora with ventral spines, pleuroterga with fine erect hairs and thorax comparatively elongate. The presence of humeral bristles separates this genus from the other genera under the tribe. It also differs from any known species of *Adrama* in having only one pair of inferior fronto-orbitals.

Medium-sized, predominantly yellow, with thorax elongate, resembling *Adrama* of the *rufithorax* group in general appearance except for the more conspicuously elongate ovipositor (Fig. 2B). Reduced chaetotaxy on head (Fig. 1C). Thorax mainly yellow to rufous except for median white dorsal vitta and lateral white stripes along pleuron. 1 pair humeral bristles well-developed (Fig. 1E). Posterodorsal thoracic bristles reduced to 1 pair scapulars, 1 pair dorso-centrals, 1 pair supra-alars and 2 pairs post-alars.

Also differs from *Adrama* Walker as diagnosed by Hardy (1986: 58) in membranous post-coxal metathoracic area, antenna exceeding epistome, presence of only 1 inferior fronto-orbital, outer vertical bristle present, genal bristle present, wing with lobe of cell *Cu* shorter than usual. Male genitalia with aedeagal apodeme articulating to hypandrium by a single ventral vane; female piercer narrow, elongate and entirely without lateral apical teeth. See discussion for the validity of these distinctions.

Wing mainly hyaline (Fig. 2A), with vein R1 densely setose from distinctly before base to margin. R4+5 sparsely setose from node of Rs to before r-m crossvein.

Legs yellow. Front femora with 1 row ventral spines, mid and hind femora with 2 rows of ventral spines.

Abdomen setose, slender, length about 3.5 times breadth, sides almost parallel at some tergites. At least 2 pairs of strong bristles on the terminal tergite when seen from dorsal in both sexes. Female tergite 7 strongly sclerotised, narrow fusiform. Piercer smooth and slender, pigmented brown. Length 1.3 mm. Spermathecae 3. Male epandrium globose, pigmented. Cerci fused, setose. Apical bristles conspicuous. Anal papillae absent.

**Etymology.** - Hardy (1974) encountered a specimen almost certainly belonging to *Hardyadrama* in the Bezzi collection (Milano), recognised that it required a new genus and described the single defective female but did not name it. He diagnosed this "new genus near *Adrama*" (l. c.: 110) and included it in his generic key (l. c.: 99). He did not mention the genus in his revision of Indonesian Adramini (Hardy, 1986), nor include it in his key to world genera, but it clearly influenced his diagnosis of the tribe. It is therefore appropriate that this genus should be dedicated to Prof. D. Elmo Hardy in recognition of his outstanding contributions to the systematics of oriental Tephritidae.

**Remarks.** - The specimens of *Hardyadrama* collected and examined by this author concur with Hardy's description of his specimen, although a complete match has not been possible due to Hardy's defective specimen. There is a possibility that these could be different species but they are almost certainly the same genus.

***Hardyadrama excoecariae*, new species**

(Fig. 1, 2, Pl. 1A)

**Material examined.** - Holotype - male (NHM), Sungei Buloh mangroves, coll. (reared) C. S. C. Lee, 23.x.1990.

Paratypes - female (allotype) (NHM), data as holotype, reared 22.x.1990; male (NHM), data as holotype, feral 16.xi.1990; female (NHM), Sungei Buloh mangroves, coll. D. H. Murphy, feral 11.ix.1988; 2 males, 3 females (ZRC), data as holotype, all with wing and genitalia preps; male, female (USNM), Mandai mangroves, coll. D. H. Murphy, feral, 6.ix.1989; male, female (BPBM), data as holotype; male (DPI), Sungei Buloh mangroves, coll. D. H. Murphy, 15.ix.1988; female (DPI), same data as holotype. All localities in Singapore.

**Description.** - Male: body length 6.5 - 7.5 mm., wing 4.93 x 1.80 - 5.73 x 2.00 mm. Reared material significantly smaller than feral.

Colour of head, body and legs yellow except for white median dorsal and pleural longitudinal thoracic vittae and black ocellarium and apex of abdomen. Bristles black, conspicuous. General body surface also with pigmented appressed setulae.

On thorax (Fig. 1E), dorsal white vitta of scutum narrowed from just after anterior margin, broadest at posterior margin, scutellum with medial 1/3 of width white, otherwise yellow. Lateral pale white stripe running along side of thorax from posterior pronotum, covering 1/3 of anepisternum to wing base.

Head (Fig. 1B, C, D) with ocellar and post-ocellars absent. Post-orbital setae black, small, a conspicuous row of divergent lateral cervical setae. 1 pair reclinate superior fronto-orbitals, 1 pair incurved inferior fronto-orbitals. 1 pair inner verticals, strong, black, 1.5 times as long as outer verticals. Face gently convex just below the antenna and strong concave approaching protruding epistomal ridge. 3rd antennal segment as in most *Adrama*, as long as face, round at apex; length at least 3 times breadth. Arista very slightly plumose, the cilia hardly longer than axis wide at base; length at least 1.5 times as long as 3rd antennal segment. Genae 1.5 time width of 3rd antennal segment, sparsely microtrichose with fine yellow hairs. Genal bristle almost as long as inferior fronto-orbitals.

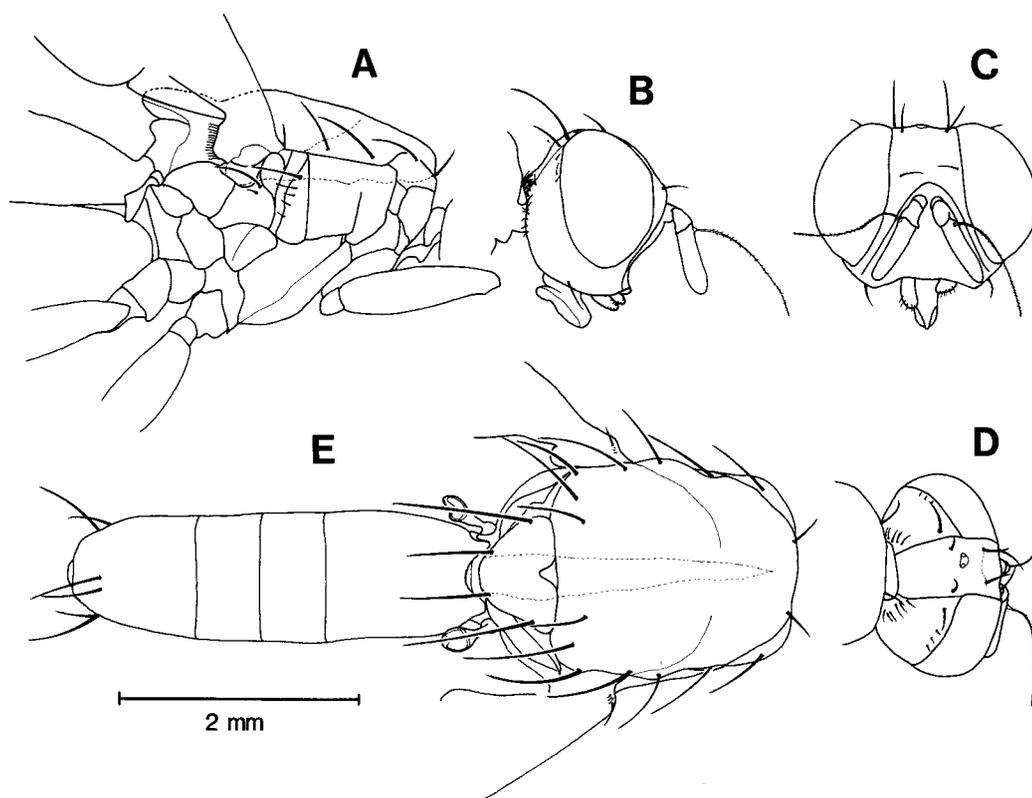


Fig. 1. *Hardyadrama excoecariae*, new genus, new species, male. A. Thorax, lateral view; B. Head, lateral view; C. Head, anterior view; D. Head, dorsal view; E. Thorax and abdomen, dorsal view.

Thorax (Fig. 1E) with scutum and scutellum dorsally pubescent with fine appressed black setulae except for region of white median stripe. One pair humeral bristles well-developed. 1 pair scapulars, 1 pair supra-alars, 2 pairs post-alars, one pair dorsocentrals very close to scutellar suture. 2 strong notopleurals. Sternopleuron pubescent with microscopic fine yellow hairs; bristles absent. 1 strong black bristle on anepisternum, others in row weak and inconspicuous. Pteropleural bristle present. Propleural bristle absent. Mediotergite with long erect pale hairs, pleurotergite without long hair but with dense short pale microtrichia along whole length of dorsal margin. Scutellum flat, with black setulae and with 4 strong scutellar bristles, equal in length.

Postcoxal metathoracic bridge entirely membranous, easily pierced by a needle in dry material.

Legs with single row of 4 - 7 posteroventral spines on front femora from beyond middle almost to apex and a row of numerous weak anterodorsal bristles. Double rows of ventral (antero and posteroventral) spines on apical 2/3 to 3/5 mid-femora and usually about distal half of hind femora. Mid femur with 2-3 posterodorsal subapical bristles, hind with 2-3 anterodorsal subapical bristles. Prominent apical spur on mid-tibia.

Wings 3 times long as broad (Fig. 2A), membrane coarsely microtrichose except for basal half of first basal cell (radial cell), anterior half of second basal cell (medial cell), most of alula except for extreme anterior margin, and along the rudimentary second anal vein. The microtrichiation is modified in the apical hyaline spot, which is milky white to the naked eye, situated between R4+5 and M1+2. Rest of wing mainly hyaline except for a yellow costal band through costal cells, subcostal cell and cell R1, with a brown apical costal band beginning from apex of cell R1, extending along anterior wing margin across apical 1/4 of cell R2+3 and terminating just posterior of vein R4+5. A distinct, white hyaline spot with marked reduction of microtrichia at wing apex between R4+5 and M1+2. Tinge of yellow on upper portion of cubital cell. Costal vein terminating at vein M1+2. Rs setose from distinctly before base to wing margin. R4+5 setose from node to before r-m crossvein. 3rd costal section 2/3 that of 2nd costal section.

Male abdomen slender, 3.5 times as long as broad. Sides parallel at tergites 3 and 4, 5 abdominal tergites visible from dorsal view. Tergites 1 and 2 fused, length equals 1/3 of total unextended abdomen. Tergum 5 bears strong bristles; 1 pair very close together on dorsum, 3/4 from anterior margin. 1 pair lateral, located close to posterior margin and 1 pair ventro-lateral (Fig. 1E). Sternite 5 bears 1 pair strong bristles situated near posterior margin. 1 lesser pair found close to former, located slightly more ventral and anterior.

Male genitalia as shown in the figures (Fig. 2E, 2F). Epandrium globose, slightly flattened anteroposteriorly, darkly pigmented except for anterior margin. Cerci fused, setose with paired apical bristles. Anal papillae absent. Surstyli slender, almost straight, apex obliquely truncated. Arms of sternite 10 fused to surstyli on their inner side almost completely except for the free, bilobed ends. Aedeageal apodeme strongly curved, with single ventral vane and a pronounced dorsal process. Hypandrium asymmetrical, with 2 anteromedian processes. Width of ejaculatory apodeme varies in specimens ranging from slender to moderately fan-shaped.

Female (Plate 1A) : body length 7 - 8.5 mm., up to and inclusive of tergite 7; wing 5.85 x 1.88 - 6.00 x 2.00 mm.

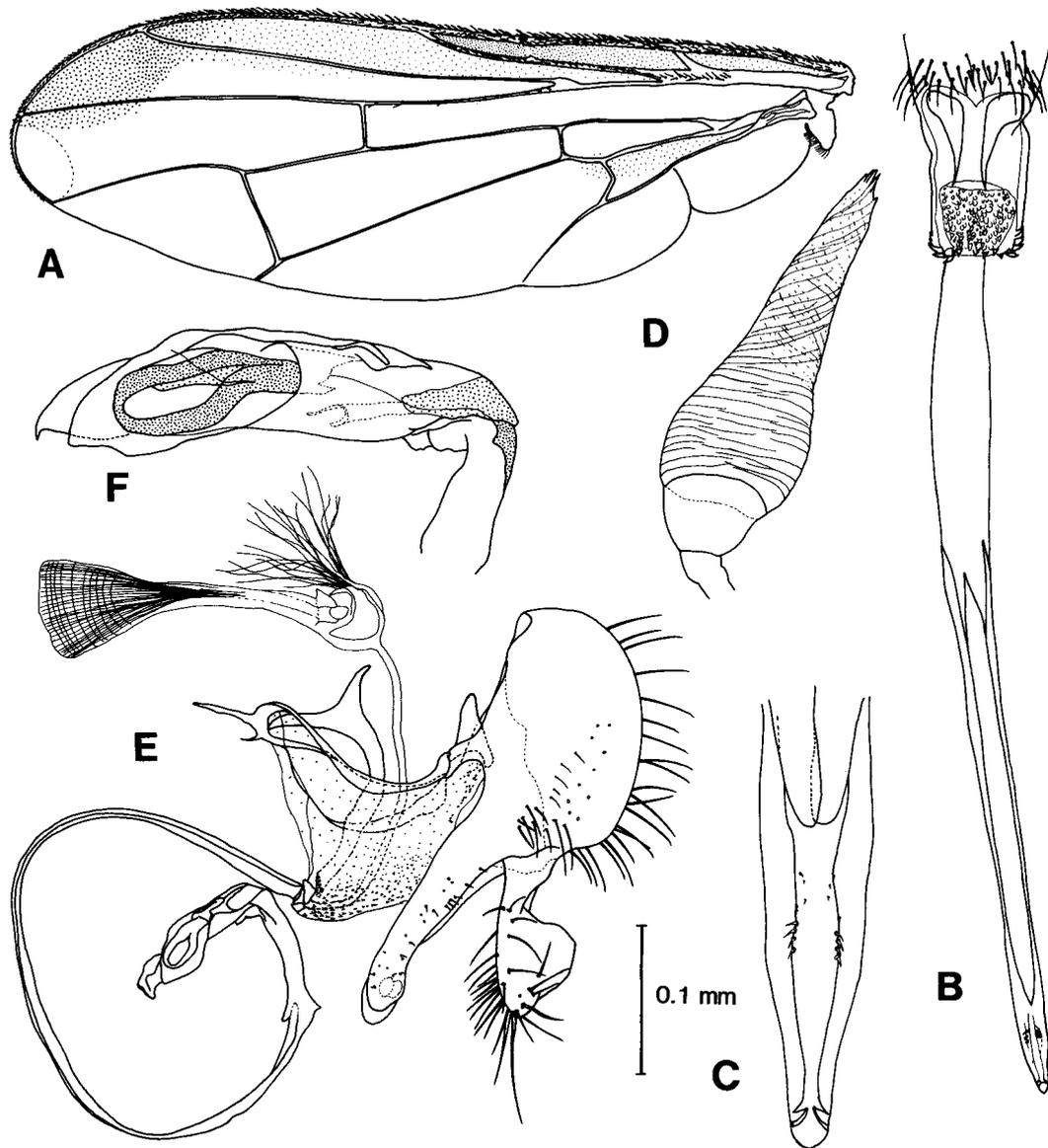


Fig. 2. *Hardyadrama excoecariae*, new genus, new species. A. Male wing (x1); B. Ovipositor (x2.5); C. Apex of piercer (x10); D. Female spermathca (x10); E. Male genitalia, lateral (x3.5); F. Aedeagus (x10)

Abdomen slender, length (inclusive of tergite 7) about 4 times width. Sides almost parallel from 2nd to 5th tergite. Tergite 1 and 2 fused, 1/3 total length of abdomen, excluding ovipositor. Tergite 7 strongly sclerotised, tubular. Length equal to tergites 1 to 4. 1 pair lateral bristles on hind margin of tergite 6. Sternite 6 bears 1 bristle on right and 2 on left hind margin, showing an unusual assymetrical distribution.

Female genitalia as shown (Fig. 2B, C, D). Piercer slender, with sides almost parallel, uniformly tapering to apex without serrations. 4 pairs of paramedian sub-apical spines evenly spaced, situated some distance from tip. Spermathecae 3, long slender conical.

***Adrama magister*, new species**

(Fig. 3, Pl. 1C)

**Material examined.** - Holotype male (NHM), Lim Chu Kang mangroves, coll. (reared) C. S. C. Lee, 24.viii.1990.

Paratypes - female (allotype) (NHM), Sungei Buloh mangroves, reared C.S.C. Lee, 24.x.1990; male (NHM), Sungei Buloh mangroves, coll. C.S.C. Lee, feral 16.xi.1990; female (NHM), Sungei Buloh mangroves, coll. C.S.C. Lee, feral, 16.xi.1990; paratypes male, female (USNM), Sungei Buloh mangrove, coll. C.S.C. Lee, feral, 16.xi.1990; paratypes male, female (BPBM), data as holotype; paratypes male, female (BPBM), Sungei Buloh mangroves, coll. C.S.C. Lee, feral 16.xi.90; male (DPI), same data as holotype, reared C.S.C Lee, 31.viii.90; female (DPI), Sungei Buloh mangrove, reared C.S.C. Lee, 23.x.90; paratypes 9 males, 5 females (ZRC), Sungei buloh and Lim Chu Kang mangroves, reared C.S.C. Lee, viii.90 - xi.90; paratypes 10 males, 4 females, Sungei Buloh mangrove, coll. C.S.C. Lee, feral, x.90 - xi.90.; with 6 sets of wing and genitalia preps. All localities in Singapore.

**Description.** - Fitting in a species complex with *A. rufithorax* Malloch and *A. fuscoapicata* Walker from Solomon and Bismarck islands by having 4 scutellars present and thorax predominantly rufous and no black marking on face. However, it differs from *A. fuscoapicata* by having a brown fascia across the r-m crossvein (Fig. 3A). It relates closely to *A. rufithorax* but for the narrow brown apical fascia that runs across the wing over 2nd M cross-vein and ends at M3+4, not completely covering the apical 1/4 of wing. Also, the 2 fascia are distinct and unconnected, unlike *A. rufithorax* which has the 2 transverse fascia continuous on the costal wing margin. Post-coxal area sclerotised but unpigmented.

Male: body length 5.5 - 6.5 mm., wing 4.42 x 1.37 - 4.66 x 1.47 mm. Reared material significantly smaller than feral.

Head, face, epistome yellow, including occiput and epicephalon except for ocellarium which is black. Ocellars, post-ocellars and vibrissa absent. Post-orbital setae inconspicuous. 2 pairs of weak inferior fronto-orbitals, 1 pair superior fronto-orbitals strong. 1 pair outer verticals 3/4 length of pair of inner-verticals. Face gently concave in median portion, with epistome margin protruded. Genae 1 to 2 times breadth of 3rd antennal segment. Genal bristle weak but present. 3rd antennal segment longer than face; length 3 times breadth. Arista with very short cilia hardly longer than width of axis; about 1.5 times length of 3rd antennal segment.

Thorax with scutum pubescent, predominantly yellow except for 2 white vittae on the dorso-central lines from just after the anterior margin of mesonotum up to the hind margin of the scutum, not extending into scutellum. Prominent white vittae on sides of thorax ventral to the wing, covering median portion of humerus, upper 1/3 of an episternite and extending to anterior edge of wing base. Otherwise thorax predominantly yellow, all thoracic bristles black. 2 pairs intra-alars, situated just dorsal of wing, the 2nd pair level with the a pair supra-alars that is situated just anterior of the scutellar margin. Dorso-central, prescutellar, acrostichal, humeral, post-humeral, presutural and post-sutural bristles absent. Sternopleuron pubescent with fine yellow hairs. Sternopleural and propleural bristles lacking. Mediotergite with long, erect pale hairs; pleurotergite without long hair, posterior 1/3 with dense, short, pale pubescence.

The post-coxal metathoracic area is definitely sclerotised although pale coloured and slightly pollinose, giving the impression of membrane, but unlike in *Hardyadrama* this cannot be pierced by a needle. It forms a completely flat, circular sclerite visibly separate from the immediate post-coxal sclerotisations.

Scutellum yellow, flat, pubescent except for median 1/3. 4 strong scutellar bristles, all equal length.

Legs yellow with black hairs. Front femora with one single row of 4 - 7 ventral spines from middle to near apex. Antero and posteroventral spines on apical 3/4 to 4/5 of the mid femora and 1/2 to 2/3 of the hind femora. Front femur with 2 to 4 posterodorsal subapical bristles, hind with 2 - 3 anterodorsal subapical bristles. Front tibial spur absent. Strong apical spur with cluster of 3 lesser spines on mid-tibia. Single apical spur on hind tibia weak.

Wings (Fig. 3A) with microtrichiation similar to that of *Hardyadrama excoecariae*, except for reduction between fasciae, with narrow brown fascia across r-m vein, extending from costal margin to past M1+2. Shadowing of apical 1/3 of radial cell from costal margin between R2+3 and R4+5, with narrow band running over 2nd m crossvein and ending at hind margin of wing. Yellow tinge in the costal cell and over basal half of the Rs cell. Otherwise, wing hyaline. An apical clear spot between R2+3 and R4+5 has reduced microtrichiation and is milky to the naked eye. Costal vein terminates at M1+2, strongly spinose up to R4+5, fracturing just after the humeral vein and at the sub-costa. R1 spinose from just before base to costal margin. R4+5 sparsely setose from base of R2+3 to 1/3 before r-m cross-vein. Medial cell as broad as cubital cell, 1.5 times as long. Vein r-m situated at 3/5 of M2 cell. 3rd costal cell 3/5 as long as 2nd section.

Abdomen yellow, about 4 times long as wide. 5 tergites seen from dorsal, tergites 1 and 2 fused, length 1/3 of unextended abdomen. Tergite 3 widest, 3 times wider than long. Hind margin of tergite 5 rounded, bearing 6 strong black bristles in a row 1/4 distance from hind margin.

Male genitalia as shown in figure (Fig. 3E, 3F, 3G). Epandrium globose, darkly pigmented and setose (Fig. 3 E). Cerci fused, unpigmented and setose, with 1 pair of apical bristles. No anal papillae. Surstyli slender, gently upturned, slightly obliquely truncated at apex. Aedeagus rather large (3F). Aedeageal apodeme with single ventral vane, with dorsal extension arm as long as vane. Ejaculatory apodeme slightly pigmented, fan-shaped (Fig. 3G). Hypandrium

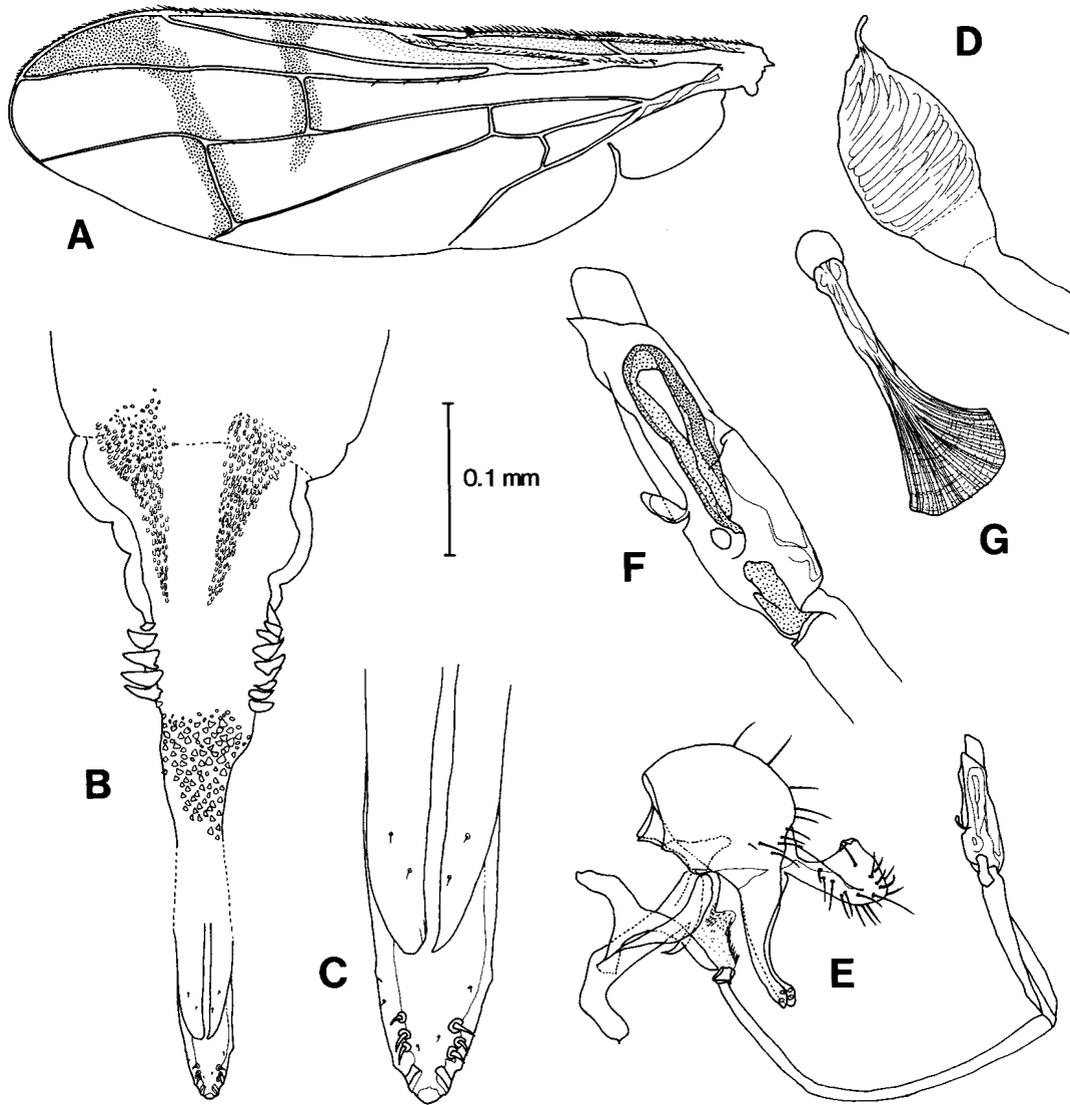


Fig. 3. *Adrama magister*, new species. A. Male wing (x1); B. ovipositor (x10); C. Apex of piercer (x25); D. Female spermatheca (x10); E. Male genitalia, lateral (x3.5); F. Aedeagus (x10); G. Ejaculatory apodeme (x3.5).

assymmetrical, with median anterior process enlarged.

Female (Plate 1C) : body length 6.0 - 7.0 mm (inclusive of tergum 7), wing 5.05 x 1.73 mm - 4.81 x 1.56 mm. General features exactly as in male.

Abdomen fusiform, at least 3.5 times width, with strongly sclerotised 7th tergite pigmented at apical half, not quite as long as tergite 1-3, with a dorso-median suture-like line. Terga 1 and 2 fused, length 1/3 of abdomen excluding ovipositor. Tergum 3 at least 3 times wider than long. 2 prominent dorso-lateral bristles on hind margin of tergite 6.

Female genitalia as shown (Fig. 1B, 1C, 1D). Spermathecae 3, short conical with slightly extending tip (Fig. 3D). Piercer comparatively broad (Fig. 3B), with slight serration. Prominent lateral teeth on membrane posterior to tergum 7 (Fig. 3B). 3 pairs of strong lateral teeth evenly spaced situated close to the apex.

**Etymology.** - The specific name *magister* is latin for teacher, in appreciation and recognition of the influence Prof. D. H. "Paddy" Murphy has had on the author over the years. In over 30 years of distinguished career in a multitude of academic disciplines, he has trained and enlightened hundreds of students of which the author is but the most recent. I take great pleasure in dedicating this species in his honour.

#### ***Elleipsa quadrifasciata* Hardy 1970**

(Fig. 4, Pl. 1B)

**Remarks.** - Hardy (1970) examined the type specimen collected at Dalawan Bay, Balabac, Philippines and designated it as a new genus in the Tribe Euphrantini by virtue of having the arista bare, lacking dorsocentral bristles and by having rows of short black ventral spines on the middle and hind femora. However, neither the female nor genitalia of either sex were examined. No known host was associated with the species. His work is supplemented here with further descriptions of the female as well of as the male and female genitalia.

The external characters of the female are as given for the male. No difference in wing pattern, venation, body colouration and chaetotaxy was detected.

Male genitalia as shown in the figure (Fig. 4A, B). Epandrium (Fig. 4A) pigmented, globose and heavily setose. Cerci unpigmented, fused and setose with long apical bristles. Aedeageal apodeme with widely separated lateral flanges inserting separately on the hypandrium. Hypandrium assymmetrical with no prominent extensions. Surstyli slender, sternite 10 only partially fused to inner surface of surstyli, terminating in pigmented, bilobed knobs. Ejaculatory apodeme slender.

Spermathecae 3, club-shaped with transverse annular striations on surface (Fig. 4C). Piercer relatively short, moderately serrated (Fig. 4D). Apex sharply tapered. 4 pairs deep-seated sockets evenly spaced near apex (Fig. 4E). Basal 2 pairs with inserted spines. Apical 2 pairs with

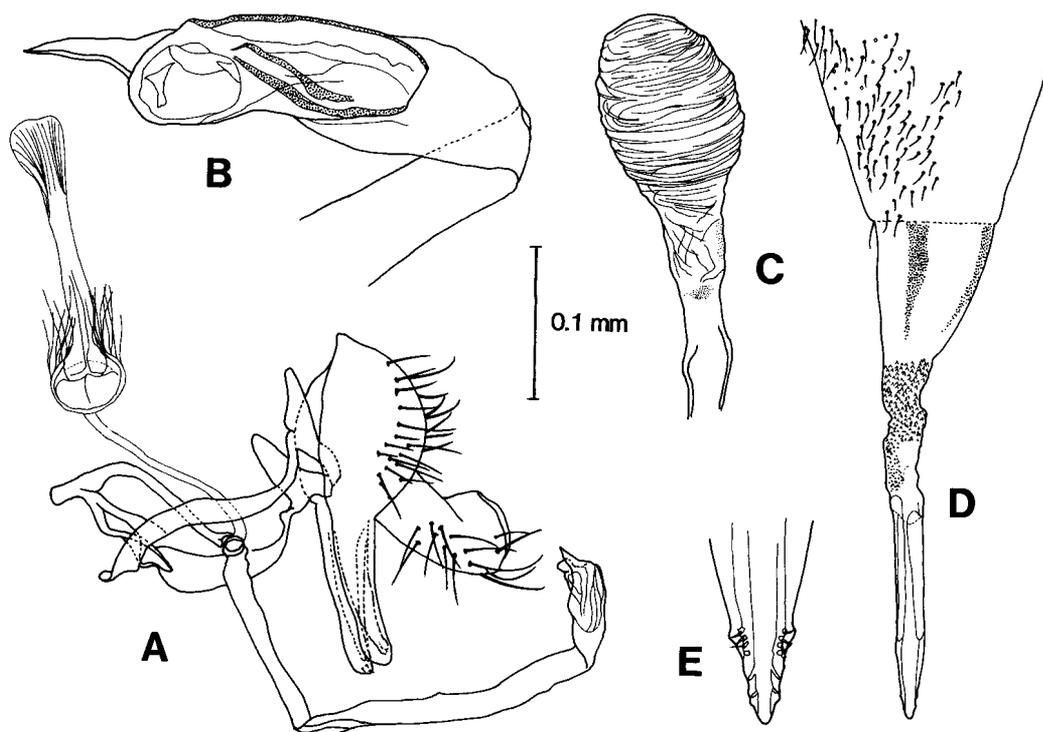


Fig. 4. *Elleipsa quadrifasciata* Hardy, 1970. A, Male genitalia, lateral (x3.5); B, Aedeagus (x10); C, Female spermatheca (x10); D, Ovipositor (x2.5); E - Apex of piercer (x10).

inserted setae.

#### DISCUSSION

The three species described here are, in spite of their similar biology, very distinct from each other and fall on current classification into the two tribes Adramini and Euphrantini. However as Hardy (1983) has pointed out, the current higher classification is still controversial. The classification on external features does not closely parallel what little is known of internal structure and in very few Adramini have the male genitalia been properly studied.

Hardy's statement in the genus diagnosis for *Adrama* (1986: 58) that the male genitalia are "with vanes of aedeagal apodeme widely forked, rather similar to those of *Dacus*" is substantiated in the literature only for three species, all members of the *determinata* complex and is here confirmed to be true for Singapore material (apparently of *determinata* Walker s. str.). It is not known for any of the others. The male of *Elleipsa* (Euphrantini) described here has the same type of aedeagal apodeme, but the species here provisionally described in *Adrama*, *A. magister*, has a simple type very similar to that of *Hardyadrama*. Hardy (1983: 167) illustrates what

appears to be a similar type of apodeme in *Euphranta macularis* (Wied.), a species which on ovipositor structure must be quite remote. The aedeagal apodeme is a single character and until more widely studied and correlated with other characters we cannot let it challenge the existing system where the genera are defined largely on chaetotactic characters. Nevertheless, it seems possible that *Adrama magister* is closer to *Hardyadrama* than to the *Adrama determinata* complex.

The very differently sclerotised post-coxal metathoracic bridge, details of wing microtrichiation, and relatively weakly toothed piercer also support this view.

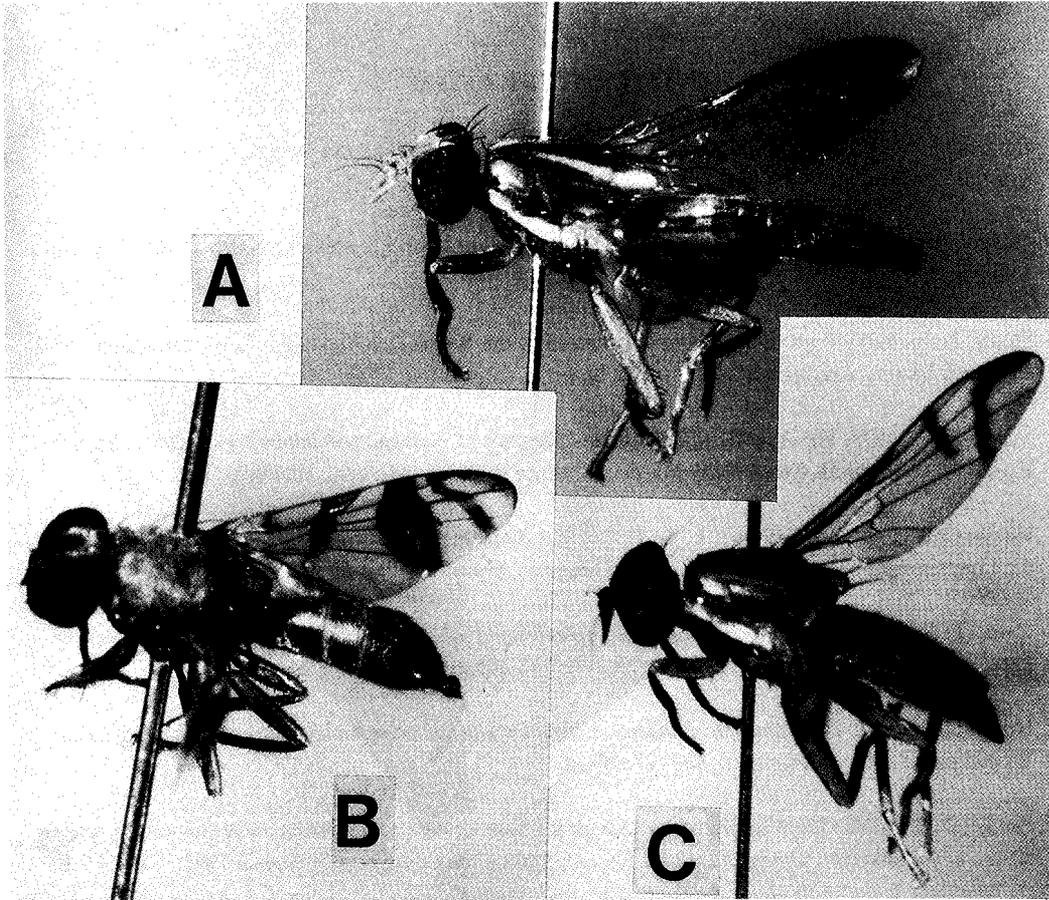
The post-coxal metathoracic bridge is a feature stressed by Hardy. In *Adrama determinata* Walker, the area is strongly produced, heavily sclerotised, rather rugose, and shows no separation into median and lateral sclerites. The condition in *A. magister* seems fundamentally different, both from typical *Adrama* and from forms with a membranous post-coxal area. That yet another new genus may have to be created, perhaps also to receive some other species currently treated in *Adrama* seems a real possibility. This view was also expressed by a referee, who also suggested that this taxon and *Hardyadrama* might be better placed in Euphrantini. However, until other species have been described in more detail, the significance for higher classification of the post coxal metathoracic sclerotisation, like the aedeagal apodeme, cannot be evaluated at present and it is preferred to leave *A. magister* in *Adrama* s. lat. for the present.

## BIOLOGY

Specimens of the adults of all three species have been collected in Singapore mangroves, their larvae collected and reared from *Excoecaria agallocha*. The host plant, *Excoecaria agallocha* L. (Fam. Euphorbiaceae) is one of 35 to 40 species of the mangrove species in tropical Africa and Asia to the Western Pacific (Tomlinson, 1986). In Singapore mangroves, it is commonly found in the back mangroves, usually associated with *Thalassina* (mud lobster) complexes or raised sandbanks. It is a dioecious tree with abundant white latex. Female inflorescence usually shorter than male (7 cm), flowers initially sessile, pedicel extending to 5 mm in fruit. Ovary trilocular with 3 short spreading or recurved simple styles, each locule with a single basal ovule. Fruit 3-lobed about 7mm in diameter.

Dissection of a fruit of an infested plant revealed the larva of the tephritid occupying one of the locules of the fruit. The larvae of the 3 species are indistinguishable under casual observation by microscope by this author. The larva, when hatched, feeds on the seeds in the locule. Under laboratory rearing conditions, the larva, when ready to pupate, vacates the fruit, drops to the bottom of the rearing vial and pupates in an oval, light brown puparium. When a soft tissue substrate was provided, the larva would burrow itself into the folds of the tissue before pupating. Pupation period was between 19 to 20 days and was about the same for all three species.

It was noted that the larva of all three species, prior to pupation would behave in a way very characteristic of tephritid larvae; it curls its body so that an anterior structure is hooked onto a posterior structure and on release of tension jumps as far as 30 centimetres from where it took off. This can happen several times under rearing conditions before settling to pupation and may be connected with locating a suitable pupation site, or avoiding predators such as ants. This is known to occur among a large number of tephritids (Phillips, 1946).



Pl. 1. A. *Hardyadrama excoecariae*, female; B. *Elleipsa quadrifasciata*, female; C. *Adrama magister*, female.

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