

The composition, generic placement and host-plant relationships of the *joviana*-group in the *Parallelia* generic complex (Lepidoptera: Noctuidae, Catocalinae)

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Abstract. The biosystematic position of the *Parallelia* generic complex is reviewed and a revised generic classification of its component taxa is presented. *Bastilla* Swinhoe (= *Xiana* Nye, syn. nov., *Naxia* Guenée, syn. nov.) is identified as the most appropriate genus for a large number of these taxa, including the *joviana*-group, which is reviewed in detail, with description of two new species, *B. nielseni*, sp. nov. and *B. binatang*, sp. nov. *Parallelia prouti* Hulstaert, syn. nov. and *P. cuneifascia* Hulstaert, syn. nov. are recognised as junior synonyms of *Bastilla vitiensis* Butler and two newly described Tahitian taxa are transferred into the *joviana*-group. Larval host records are examined in relation to this new generic system and significant preference for the Euphorbiaceae is noted for several groups: *Bastilla*, *Buzara* Walker (= *Caranilla* Moore, syn. nov., another segregate from *Parallelia*) and an Australian group within *Grammodes* Guenée.

Additional keywords: *Achaea*, *Bastilla*, *Buzara*, *Caranilla*, *Dysgonia*, *Grammodes*, Euphorbiaceae, Malesia, Oriental, Australasian, tropics, host specialism.

Introduction

This study marks the intersection of two programmes of research, one biosystematic, the other investigating ecological factors in the generation of biodiversity. It also draws on an exercise in informatics, collating data on the host plants of Lepidoptera (Robinson 1999; Robinson *et al.* 2001). All these themes were close to the heart of Ebbe Nielsen and we hope our venture into them provides an appropriate tribute, as well as the dedication of a new species to him.

The biosystematic programme (JDH) has as its main objective production of a series of 18 monographs (e.g. Holloway 2001) covering the Macroheterocera of the island of Borneo. A major component of this is to redefine generic concepts relevant to the Bornean fauna but within a global context where necessary. These generic definitions are based, wherever possible, on synapomorphic character states, as required for modern phylogenetic classification. This ideal, and the recognition of groupings of genera on the same basis, is often hard to attain and we recognise that success in this current study is, at best, partial. A high

proportion of the genera found in Borneo also occur widely through the Indo-Australian tropics, including the island of New Guinea, the focus of the ecological programme.

The ecological programme (SEM and colleagues) is addressing the contribution of host specialism in herbivorous insects to the accumulation of biological diversity, particularly in taxon-rich tropical areas. The approach used involves the intensive sampling of insects associated with selected plant taxa in New Guinea, with a particular focus on important families such as Moraceae, Euphorbiaceae and Rubiaceae (Basset *et al.* 2000; Novotny *et al.* 2002a, 2002b). The studies have benefited from the support of an international assemblage of biosystematists, which has brought to light lacunae in current classifications.

The co-evolutionary aspects of biotic enrichment through herbivore-host specialism can only be explored against the background of well-founded phylogenetic hypotheses for both the insect herbivores and the plant hosts. The study presented here attempts an advance in this direction for a group of noctuid moths that appear to be specialist feeders on the family Euphorbiaceae; several species were reared from euphorbs during the course of the work in New Guinea.

Methods

Methods and taxonomic context are reviewed by Holloway *et al.* (2001). This study is based primarily on the extensive collections at The Natural History Museum, London, UK (BMNH), National Museum of Natural History, Smithsonian Institution, Washington, USA (USNM) and Australian National Insect Collection, Canberra, Australia (ANIC). Representative specimens were borrowed from Bishop Museum, Honolulu, Hawaii (BPBM) and Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (RMNH). Background on the extensive rearing program in Papua New Guinea is provided by Basset *et al.* (2000) and Novotny *et al.* (2002a, 2002b). Approximately 100 genitalia dissections were examined in the *B. joviana* (Stoll)-group, and many more of related noctuids were examined. Forewing length is measured from centre of thorax to apex of forewing. Paratypes of the new species are deposited in BMNH, USNM, BPBM, ANIC, RMNH, Papua New Guinea Department of Agriculture and the Museum Zoologi Bogor, Indonesia.

The *Parallelia*-complex within the Ophiusini

The species concerned are members of the *joviana*-group (Holloway 1979) that have traditionally (e.g. Hampson 1913; Gaede 1938; Kobes 1985) been assigned to the genus *Parallelia* Hübner (type species *P. bistriaris* Hübner, USA). *Parallelia*, in turn, is a member of a widespread, but predominantly Old World, complex of genera belonging to the tribe Ophiusini of the subfamily Catocalinae (Holloway *et al.* 2001). This tribe consists of robust, medium to very large species that have traditionally been placed in the Catocalinae (as distinct from the Ophiderinae; Hampson 1913) on the grounds of a spined mid-tibia (see also Berio 1959, 1965). However, some obviously monophyletic groups, such as *Buzara* Walker (see below) and the *Avatha* Walker-group (Holloway *et al.* 1987, 2001), which share some features of the male genitalia with the Ophiusini, include taxa both with and without tibial spines. Genitalia features, particularly of the uncus and scaphium, basal valve ornamentation and coremata, X-shaped juxta and highly convoluted aedeagus vesica, are also seen in some traditionally 'ophiderine' genera that lack spines, such as *Lacera* Guenée and *Oxyodes* Guenée (illustrations in Holloway 1979). Further investigation of the relationships of these groups is planned in the relevant parts of the 'Moths of Borneo' monograph series.

The *Parallelia*-complex falls within a slightly wider group of genera in which the forewing pattern is usually banded or triangulated and includes a trapezoid or triangular area subapically, based on the costa and defined by the anterior sections of the postmedial and submarginal fasciae, bridged by a line along vein M1. This trapezoid mark is also seen, to some extent, in the genera *Achaea* Hübner and *Grammodes* Guenée, and will be used to limit the scope of this study; it is considered to be weak but present in *Parallelia sensu stricto* and *Macaldenia* Moore. *Achaea*, *Grammodes* and the *Parallelia*-complex have a high incidence of larval feeding on Euphorbiaceae, otherwise uncommon within the Ophiusini (Robinson *et al.* 2001).

The three groups share a number of features of the male genitalia, although some of these occur more widely in the Ophiusini. The uncus is robust and subtends a strong scaphium, both of which are ophiusine features, but the former may have a superuncus (e.g. Berio 1965) arising dorsobasally from it. This is a feature of *Achaea*, but is also seen in some members of the *Parallelia*-complex, and a similar feature occurs in some *Ophiusa* Ochseneheimer (Holloway 1979). The tegumen sometimes has a lateral process centrally on the right side, seen in *Grammodes* and, in the *Parallelia*-complex, *Buzara* and a few other taxa. Again, such modification occurs in typical *Ophiusa*, but on both sides, asymmetrically. The diaphragm has the X-shaped bands of thickening (juxta) typical of the Ophiusini, but these vary in development.

The valves in the three groups have coremata on the exterior of the basal (saccular) part of the valve, although these also occur in genera outside the complex such as *Chalciope* Hübner and *Ophisma* Guenée (and indeed more widely in the quadrifine Noctuidae), genera which also have basal processes of the type discussed next and may therefore also be related. *Parallelia sensu stricto* lacks coremata. The valves themselves are simple, ovate to tongue-shaped, but have a basal series of processes across their interior. There is a single or bifid process at the base of the costa and a narrower, more rod-like process in a more saccular position. In some groups these processes are well separated, but in others they become united across the base of the valve in a broad, trifid structure, with the saccular process broadened; the valve shape may also be modified and asymmetric (e.g. in *Grammodes*). In the former case, the costal process may be bilaterally asymmetric; in the latter, the whole structure may exhibit asymmetry. It is unclear whether the separate or fused condition is plesiomorphic, particularly because, of the more distantly related genera, *Ophisma* exhibits the former and *Chalciope* the latter.

The female genitalia have yet to be studied fully, but are often folded in a V- or Z-shape within the abdomen. In *Achaea*, *Grammodes* and the *Parallelia*-complex there is a pronounced lamella antevaginalis that arises anteriorly to, and protrudes as a plate (referred to in the text following as the antevaginal plate) posteriorly over, the ostium; it probably articulates with the basal processes of the valve during copulation. There is usually a short ductus bursae and sometimes the corpus bursae is divided into a narrow basal section that continues from the ductus and expands into a distal spherical or pyriform section. There is scobination and occasionally spining in these sections of the corpus bursae. The ring of the eighth segment is posterior to this and is incomplete, interrupted by a small central sclerite ventrally.

The larvae are usually slender semi-loopers, cryptically patterned in shades of dull brown with fine longitudinal striae. The pupae often have a whitish waxy bloom.

Generic concepts within the *Parallelia*-complex

Application of the name *Parallelia* to Old World taxa has long been considered unsatisfactory (e.g. Berio 1965), but attempts to find more suitable nomenclature from among the genus-group names placed as synonyms thereof by Hampson (1913) have not proved much more satisfactory. Berio (1965, 1978) assigned a number of African taxa to *Caranilla* Moore, and Poole placed all Old World species under the next most senior name, *Dysgonia* Hübner, a policy followed by Kobes (1992) and Edwards (1996). Kobes also recognised other sections as valid genera, such as *Macaldenia* Moore and *Caranilla* Moore. A review of the type species (Nye 1975) of these genus-group names (including two outside the complex), and of a wide selection of species in the complex as a whole, suggests that several clearly defined genera can be identified, but with some problem taxa still remaining difficult to place.

In *Parallelia sensu stricto*, the forewing facies is rather uniform and brownish and the trapezoid mark weak and poorly defined. The male genitalia have a simple uncus, there is no obvious scaphium and the juxta is broad. The valve lacks a corema and has the costal and saccular processes well separated, the former long, rather rectangular with slight bilateral asymmetry and the latter relatively short, digitate. The female genitalia have a moderate antevaginal plate that has a narrower central projection to its distal margin. The ductus is short, the corpus bursae with a similarly narrow neck and a strongly scobinate pyriform distal section with the ductus seminalis on a lateral diverticulum. The relationship of *Parallelia* to the rest of the generic complex is thus unclear, and 'Parallelia-complex' may therefore be a misnomer.

The survey of other groups that follows is not comprehensive at the species-level but covers all genus-group names associated with the old concept of *Parallelia* and all taxa for which host-plant data have been located.

Macaldenia Moore (= *Pasipeda* Moore, preoccupied) includes *Parallelura* Berio as indicated by Berio (1965), although Poole (1989) treated the latter as distinct. The genus consists of just the type species of the two genus-group names, *Halodes palumba* Guenée in the Indo-Australian tropics (Kobes 1992: figs 14 and 21) and *Ophiusa palumbioides* Hampson in Africa. They share a facies of rather uniform grey wings with the pattern typical of the complex only weakly expressed; in particular, there is a unique row of small white submarginal lunules on the dorsal half of the hindwing in both species. The male genitalia of both share valve features such as a single corema and processes that consist of a broad, rather spatulate, single costal process linked by thickening to a small digitate process or knob in the saccular position. However, *M. palumbioides* has a superuncus and strong, bilaterally symmetrical lateral processes from the tegumen, features

lacking in *M. palumba*. The juxta is short and broad, roughly square in *M. palumbioides* and like an inverted heart in *M. palumba*. The aedeagus has a strong subbasal flexure in *M. palumbioides* but no spining in the vesica, whereas it is straight in *M. palumba* with a scattering of many small spines in the vesica; the insertion of the ductus ejaculatorius is somewhat subbasal in both species. In the female (*M. palumba*), the antevaginal plate barely protrudes and is a shallow crescent-shape. The ductus bursae is very short, convolute, sclerotised and the corpus bursae is small, broad, reflexed.

Pindara Moore consists of a series of mainly allopatric species that spans the Indo-Australian tropics, including the type species, *Noctua illibata* Fabricius, in the Oriental region, *P. eclipsifera* (Hampson) in the Philippines, *P. serratilinea* (Bethune-Baker) in the Australasian tropics and *P. prisca* (Walker) in islands of the south-west Pacific (Holloway 1979: 476). The wings are a rather uniform violet-brown, the forewing with weak paler fasciae and a well developed reiform stigma. The postmedial fascia is distinctly crenate. Only the trapezoid mark is darker, although variable in shape. In the male genitalia, the uncus is domed or has a superuncus. The tegumen is unmodified. The valves are large, oval, with a single corema. The basal processes are bilaterally symmetric, with the more costal two fused to give a bifid process and the saccular one rod-like, somewhat separated from the other. The juxta is relatively short and broad. The aedeagus has a relatively basal ductus ejaculatorius; the vesica has a scobinate diverticulum, but no strong cornuti. In the female (*P. illibata*, *P. prisca*), the antevaginal plate can be acutely bifid, short, but rather broadly based. There is a slender, asymmetrically forked process associated with the ostium. The ductus bursae is strongly sclerotised, the corpus bursae being large, elongate, ovate to pyriform.

Dysgonia Hübner *sensu stricto* was reviewed by Berio (1955), including the type species *Noctua algira* Linnaeus, *D. torrida* (Guenée) (with *D. properans* (Walker) as a synonym), *D. orbata* Berio and *D. stuposa* (Fabricius). These species range from Africa through the Mediterranean to the Oriental region and are possibly more characteristic of semi-arid habitats; the last species extends to Sumatra (Kobes 1992). Current studies suggest the genus should also include *D. latifascia* Warren from the Indian subregion, and possibly species with similar facies in Australia such as *D. constricta* (Butler). The facies and male genitalia of *D. senex* (Walker), also from Australia, are consistent with placement in *Dysgonia*.

The forewing facies of *Dysgonia* shares some features with the next genus, *Bastilla* Swinhoe. The area between the forewing postmedial and medial fasciae is significantly darker (usually dark brown) than the rest of the wing, except the trapezoid mark; this tends to have its distal margin strongly notched in *Dysgonia*, with a fine white line cutting off the costal/apical section beyond the notch; in *Bastilla* the

notch tends to be weak or (usually) absent, and the white line is rarely present. The postmedial border of the major dark zone often has a secondary angle posterior to the one at the junction with the trapezoid mark; this occurs between veins M3 and CuA1 in *Dysgonia*, but usually more posteriorly in *Bastilla* (in the *joviana*-group, dark dots occur on these two veins between the two peaks, the posterior peak coinciding with CuA2). In the male genitalia, the uncus is typically bifid apically and occasionally has a weak superuncus. The valve has a single corema and the processes are distinctly triple and fused basally across the valve; there is some bilateral asymmetry. The X-shaped juxta has a long, narrow central section between the dorsal and ventral divergence. The aedeagus is short and straight, the ductus ejaculatorius is relatively basal and the vesica has numerous diverticula, some scobinate, but with no strong cornuti. The female (*D. algira*) has the antevaginal plate moderate, somewhat triangular and distally cleft. The ductus bursae is very short and the corpus bursae is pyriform, slightly convolute basally.

Bastilla Swinhoe, gen. rev. possibly represents the largest grouping within the traditional concept of *Parallelia*, and includes as synonyms *Xiana* Nye, syn. nov. and *Naxia* Guenée (preoccupied, *Xiana* being the replacement name), syn. nov., and also the Afrotropical '*Caranilla*' species of Berio (1965, 1978). The facies of the forewing bears some parallels with that of *Dysgonia* as indicated above, but the forewing postmedial fascia is more frequently smoothly concave posterior to the angle at the junction with the trapezoid mark, and when a secondary angle does occur, this is usually posterior to vein CuA1. This section of the postmedial fascia is particularly irregular in '*Caranilla*' *sensu* Berio, to which the widespread Indo-Australian species *B. simillima* (Guenée) is probably related (placed also in *Caranilla* by Kobes (1992), who otherwise treated the genus as discussed below for *Buzara* Walker), but has an unusual triple corema. The uncus is usually simple, although a moderate superuncus occurs in the '*Caranilla*'-group and species allied to *B. crameri* (Moore) (see below). The definitive features are in the valves, in which the coremata are double rather than single, sometimes even triple, a feature shared with *Buzara*, but not in combination with bilateral symmetry of the valve processes. These consist of a single, elongate, distally ornamented costal one and a well-separated, slender, rod-like saccular one. The juxta is often short, broad, even rather H-shaped. The aedeagus is strongly curved or angled, insertion of the ductus ejaculatorius is basal or subbasal and the vesica can be globular or with diverticula, but usually with groups of relatively robust spines or cornuti.

Within *Bastilla* a number of subgroups are evident. The type species of *Bastilla* (*Ophiusa redunca* Swinhoe = *Naxia hamatilis* Guenée) extends through the Australasian and south-western Pacific tropics (Holloway 1979: 476) and may be sister to the primarily Oriental type of *Xiana*, *Naxia ab-*

sentimacula Guenée. Both occur in Australia (Edwards 1996). They have a rather domed or crested uncus and relatively short costal processes to the valve. The '*Caranilla*'-group of Berio has already been mentioned. The *joviana*-group is discussed in the next section and is defined by a double angle to the forewing postmedial fascia with an intervening pair of dots, a characteristic aedeagus and vesica in the male and a trapezoid antevaginal plate in the female. It may be most closely allied to a suite of species with an evenly curved posterior section of the postmedial, but with a relatively uniformly paler forewing basal to the medial that includes species such as *B. acuta* (Moore), *B. amygdalis* (Moore), *B. arcuata* (Moore), *B. axiniphora* (Hampson), *B. copidiphora* (Hampson), *B. dicoela* (Turner), *B. flavipurpurea* (Holloway), *B. koroensis* (Robinson), *B. lateritica* (Holloway), *B. maturata* (Walker) and *B. maturescens* (Walker).

There is a smaller group of relatively large species allied to *B. crameri* (Moore) (including *B. analis* (Guenée), *B. fulvotaenia* (Guenée) and *B. praetermissa* (Warren)) that have a smoothly curved posterior part to the postmedial, but the area of the forewing basal to the antemedial is as dark as the medial to postmedial triangle, the two separated by a broad white band. On the hindwing there is a conspicuous, almost ocellate mark subternally. The male genitalia have a superuncus, the costal valve processes are partially fused to an elongation of the vinculum dorsal to the valve costa, the coremata are treble in some of the species and the aedeagus is long, slender, flexed at a right angle at one-third, the vesica small, but with finely spined diverticula.

All these species are newly combined with *Bastilla*.

Exemplar females of all the main groups in *Bastilla* have been dissected, but no clear generic synapomorphies were located. The shape of the antevaginal plate is variable, but it is always well developed. It is squarish with an excavate anterior (basal) margin in *B. hamatilis*, but smaller and distally more bilobed in *B. absentimacula*. It is smallest in the '*Caranilla*'-group of Berio (rounded in *B. simillima*, more square in *B. angularis* (Boisduval), with a strongly asymmetrically excavate basal margin). In the *crameri*-group (*B. analis*) it is completely divided into a pair of tongue-like lobes that flank the ostium. The trapezoid shape of the plate in the *joviana*-group will be described in the next section; the basal margin is much broader than in any other group; it is much narrower in species, such as *B. maturata*, that may be most closely related.

The ductus bursae is usually sclerotised, strongly so in *B. hamatilis*, where the ostium is prominent, with an irregular margin; *B. absentimacula* lacks this last feature. The '*Caranilla*'-group has the ductus short (*B. simillima*) or vestigial and unsclerotised (*B. angularis*). In *B. analis* it is similar to that of *B. absentimacula*, whereas that of *B. maturata* is more as in *B. hamatilis*. In the *joviana*-group it is more simply sclerotised, as in *B. absentimacula*.

The corpus bursae is usually divided into a basal section, often with a protrusion leading to the ductus seminalis, and a distal section that is spherical or pyriform; this division is least evident in the ‘*Caranilla*’-group and *B. analis*, where the basal section is reduced. In *B. maturata* and the *joviana*-group it is more evident and contains fields of spines.

A few robust South American species (e.g. *B. expediens* (Walker)) may also belong to *Bastilla*. The male genitalia of *B. expediens* have a superuncus, an appropriate valve structure with a deeply based, short, but slightly doubled corema and a curved aedeagus with a highly convoluted vesica.

Buzara Walker is based on an unusual, black and cadmium yellow New Guinea species, *B. chrysomela* Walker, that lacks the typically catocaline spined tibia, but otherwise shares distinctive male genitalic features with *Caranilla* Moore; it has the male hindwing strongly reduced and the forewing narrowed. This oft-heralded synonymy of *Caranilla* with *Buzara* (Holloway *et al.* 1987, 2001; Kobes 1992) is hereby formalised: *Caranilla* Moore, syn. nov. The genus includes several dull brown Oriental species, rather weakly and irregularly fasciated on the forewing: *B. feneratrix* (Guenée), *B. forceps* (Kobes), *B. lageos* (Guenée), *B. luteipalpis* (Walker) and *B. [Naxia] onelia* (Guenée), the type species of *Caranilla*. There is also an Australasian group in which the forewing has a weak (*B. propyrrha* (Walker)) or strong (*B. frontinus* (Donovan), *B. infractafinis* (Prout), *B. latizona* (Butler), *B. lua* (Strand), *B. roulera* (Swinhoe) and an undescribed species from Vanuatu) white medial band and the tegumen process is more strongly upcurved. All these species are transferred as new combinations from *Caranilla* to *Buzara*, which also includes *B. circumducta* Warren from the islands south-east of New Guinea. The genus has distinctive male genitalia. The uncus is straight or slightly curved, lacking a superuncus, but usually with lateral processes basally on each side. The tegumen has a broad lateral process on the right side. The valve has a double corema, as in *Bastilla*. The valve processes are broadly based, united, usually with bilateral asymmetry, the left hand complement being reduced from three to two (on both sides in *B. forceps*). The juxta has the ventral component of the ‘X’ long, the dorsal part short and fused across. The aedeagus is relatively short and straight, with the ductus ejaculatorius at one-third. The vesica, when everted, is at right angles to the aedeagus apex and has numerous relatively small diverticula; single cornuti occur at the apices of some of these. In the female (*B. chrysomela*, *B. onelia*), the antevaginal plate is relatively narrow and distally bilobed. The corpus bursae is slightly convoluted and contains areas of sclerotisation that bear small to moderate, short, triangular spines.

The genera just outlined include the majority of taxa in the traditional concept of *Parallelia*, but there are a few monobasic genera and unassigned taxa that should be mentioned briefly: the unassigned taxa should perhaps be

retained provisionally in ‘*Parallelia*’ rather than ‘*Dysgonia*’, because, although both can now be defined more concisely, *Parallelia* has historically been used in a very broad sense, whereas use of *Dysgonia* comes within more recent attempts to establish more satisfactory generic concepts within the *Parallelia*-complex.

Gondysia Berio contains a single Madagascan species, *G. pertorrada* Berio. It has a *Dysgonia/Bastilla* facies type but has the uncus elongate, apically spatulate and with a dorsal groove and small subbasal hump. The tegumen has lobes on each side. The condition of the valve coremata was not illustrated in the original description, nor was the aedeagus. The valve processes appear to be much reduced but of the fused-across, trifold type.

Euphiusa Hampson includes a single, small African species, *E. harmonica* (Hampson), which has a pale brownish, weakly marked facies. The uncus apex is bifid as in *Dysgonia*, but the valve processes are separated into a strongly bifid costal one and a digitate ventral one; there are no obvious coremata.

‘*Parallelia*’ *arctotaenia* (Guenée) is a widespread Indo-Australian species (Robinson 1975: 177–178) with facies similar to that of the *Bastilla crameri*-group, except it has a notched distal margin to the forewing trapezoid mark and lacks the rather ocellate subdorsal mark of the hindwing. The uncus is long, curved, the scaphium is weak and the tegumen is unmodified. The valves have a single corema, lack any basal processes and are themselves bilaterally asymmetric. The aedeagus is basally bilobed. The antevaginal plate of the female is rounded, small, with two digitate processes set asymmetrically on its interior surface and directed basad. The ductus bursae is short, slightly convolute and the corpus bursae is small and ovate.

‘*Parallelia*’ *rigidistria* (Guenée) is almost as widespread. It has forewing facies similar to that of the brown Oriental species of *Buzara*, with a pale-edged, straight, transverse medial fascia. The uncus is simple, the tegumen is unmodified and the valves have bilateral symmetry, with a single corema and basal processes separate: a costal, slender, bifid one and a saccular rod. In the female there is no antevaginal plate. The ostium is asymmetric, with a tongue-like process on one side, set in an elongate depression ventrally on the seventh segment. The ductus bursae is short, sclerotised. The corpus bursae is elongate, slightly constricted centrally, with a small cluster of spines at each end of the basal half.

‘*Parallelia*’ *triplocyma* Hampson is an East African species with facies similar to *Dysgonia* and *Bastilla*, but with an oblique, undulating postmedial. There is a superuncus in the male genitalia and the valve coremata are double. The valve processes are asymmetric, more as in *Buzara*, but the aedeagus is more as in *Bastilla*. Unique features include long, tapering, acute valves and an enlarged, asymmetric, strongly sclerotised and distally serrate juxta.

These generic concepts may be compared with the system of Hampson (1913). He divided his broad concept of *Parallelia* into two sections. All except three species fell into a section in which the male mid-tibia is dilated, with a groove containing a fringe of large scales, although this is also seen in genera such as *Achaea* and *Ophisma*. The North American type species of *Parallelia* and two eastern Palaearctic species lack this feature. The larger section is, in turn, divided on the presence or absence of a fringe of hair on the first hind-tarsal segment of the male, although this feature also occurs in *Ophisma*. The group possessing this feature includes *Pindara*, typical *Bastilla* and *Xiana*, the *joviana*-group and related species such as *matura* and allies, the *crameri*-group, the *Caranilla* section of *Buzara* and '*P.* *rigidistria*'. It was referred erroneously to *Dysgonia* because the type species of *Dysgonia* was then considered to be *B. joviana*. The second group was referred to *Macaldenia* and contained this genus, '*P.* *arctotaenia*' and the type species of *Dysgonia*, *D. algira*. Other species of *Dysgonia*, such as *D. stuposa*, were included in the first section. The '*Caranilla*'-group of Berio was also divided between the two sections.

Achaea Hübner

Achaea has been delimited in Africa by Berio (1965) and for the Indo-Australian tropics by Edwards (1978) and Holloway (1982, 1984). The Indo-Australian species, with the exception of *A. mezentia* (Stoll) in Sri Lanka, form a distinct subgroup that also includes the African species *A. catella* Guenée and *A. oedipodina* (Mabille) from Madagascar and the Seychelles. The male genitalia have a prominent superuncus and no modification to the tegumen. The valves have a single corema. The valve processes are well separated: a slender trifid costal one and a very slender saccular rod, curved up at the base. The costal processes usually show bilateral asymmetry, with slight reduction of the right hand one. The aedeagus is slender, curved, basally hooked, the ductus ejaculatorius subbasal within the hook. The vesica in the Indo-Australian group can have two rather elongate diverticula, one of which bears short, broad spines. The females of the Indo-Australian group (illustrated by Edwards 1978) have a moderate plate to the lamella antevaginalis, distally bilobed. The ductus is relatively long, the bursa of various shapes, ovate, large, or smaller with a central constriction.

Grammodes Guenée

Grammodes currently (Berio 1956; Poole 1989) contains a typical group of species, allied to the type species, *Noctua geometrica* Fabricius, that ranges throughout the Old World tropics and subtropics, and a small, essentially Australian group that may well merit generic status. The latter includes *G. diagamma* (Lower), *G. justa* Walker, *G. ocellata* Tepper, *G. oculicola* Walker (extending into the south-western

Pacific; Robinson 1975; Holloway 1979) and *G. pulcherrima* Lucas.

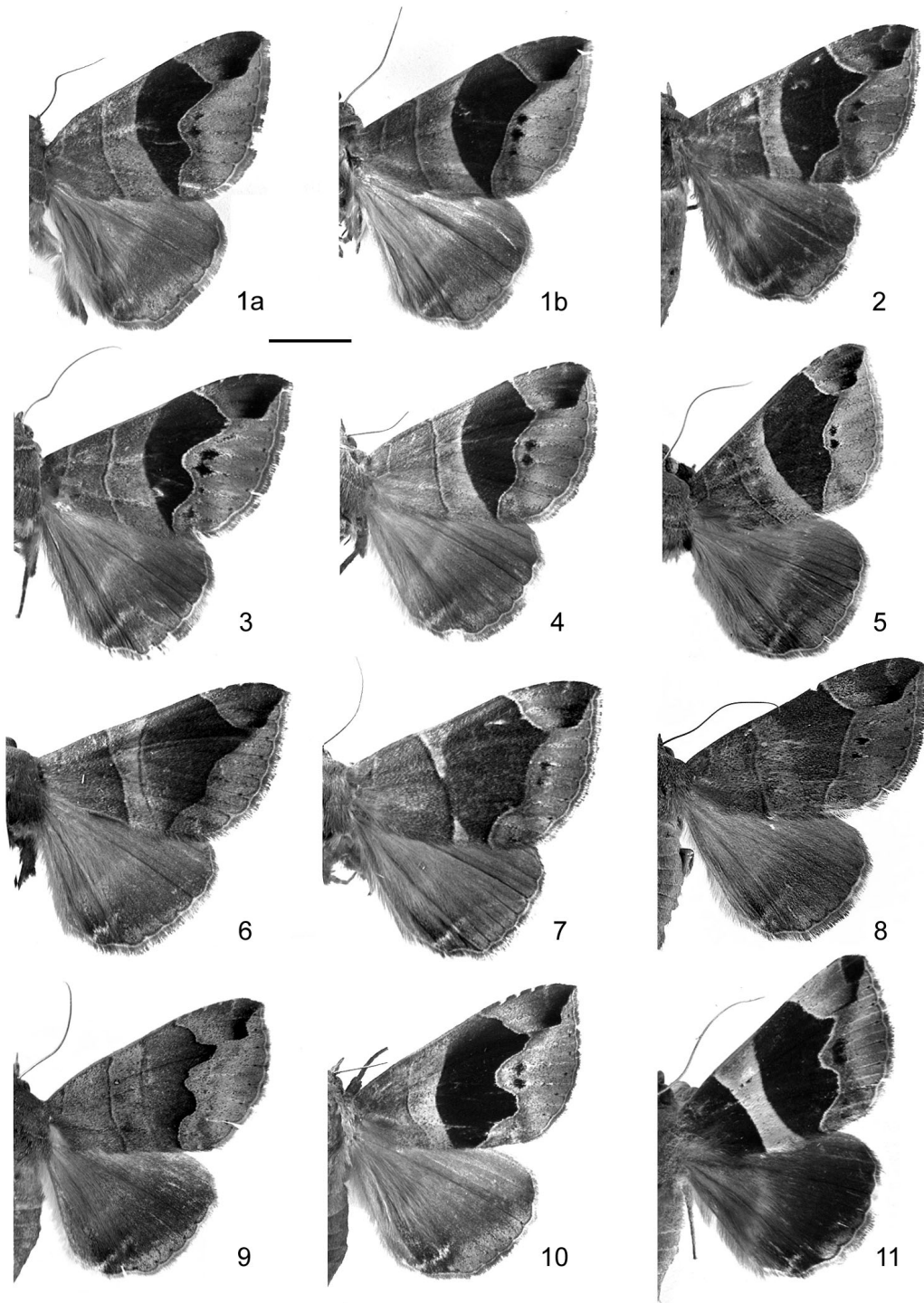
The typical group has forewing facies with a black triangle extending from the subbasal to the postmedial fasciae, divided by a medial white bar and separated from the costa by a broad strip of pale grey-brown. In the male genitalia, a superuncus is present. There is a slender lateral process on the right side of the tegumen only. The valves have single coremata and tripartite basal processes with bilateral asymmetry, the right-hand ones tending to have the dorsal two fused (or the central one lost), the reduction thus being on the opposite side to *Buzara*. The juxta is similar to that of *Dysgonia*, with a long central section. The aedeagus vesica has a corkscrew-like cornutus, mentioned by Kobes (1992), although his statement that it occurs also in *Macaldenia palumba* is erroneous. The ductus ejaculatorius is inserted basally on the aedeagus.

The Australian group has the forewing extensively dark blackish brown, crossed by two parallel, oblique, white bands, the postmedial one sharply angled basad subdorsally where, in several species, it encloses an ocellate mark at the tornus; the trapezoid mark is not evident in this pattern. The male genitalia lack a superuncus, but have slender processes on both sides of the tegumen. The valves have a single corema and the basal processes are simpler than in the typical group. The juxta is long and rectangular or with a short ventral divergence. The aedeagus vesica has one or more cornuti, but these are not distinctly corkscrewed.

The female of the typical group (*G. geometrica*) has the plate of the lamella antevaginalis rather square, although the distal margin is shallowly bifid. The ductus is short, sclerotised, the bursa with a spiny area distal to a laterally placed, corkscrew sclerotisation that leads to the ductus seminalis. In the Australian group (specimen of uncertain identity; slide BMNH 17604), the antevaginal plate is narrower, more distinctly bilobed and with concave lateral margins. There is no corkscrew to the corpus bursae, but this has areas of sclerotisation basally with coarser spines than in *G. geometrica*.

The *joviana*-group of *Bastilla*

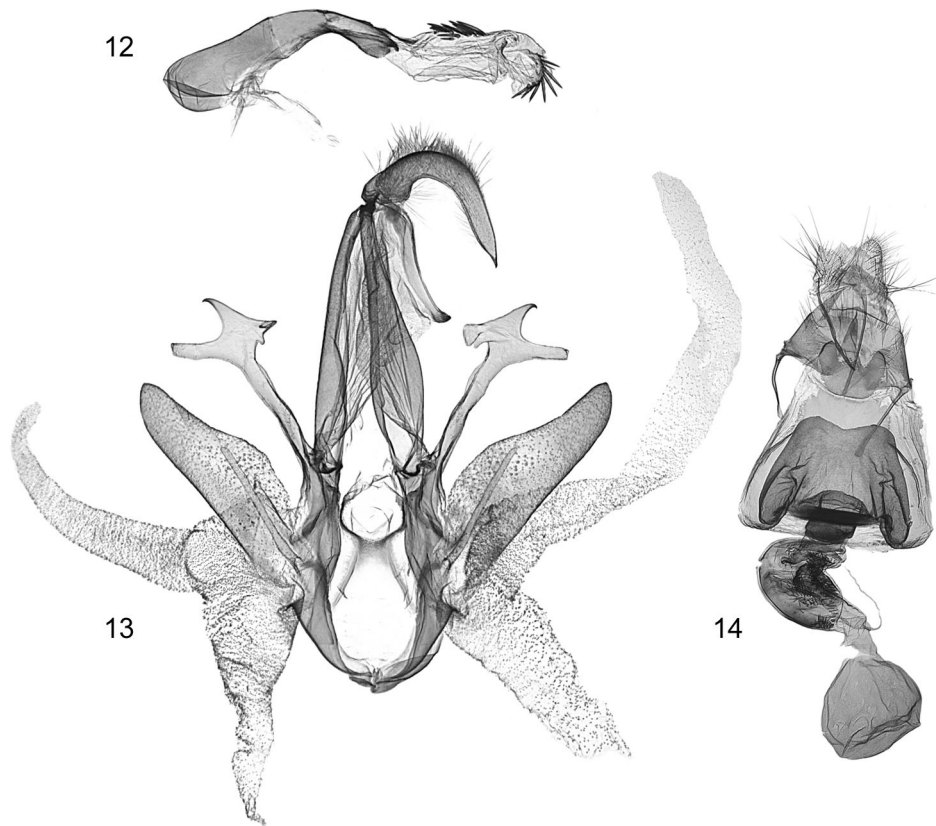
As stated above, the *joviana*-group of *Bastilla* has a distinctive second angle to the forewing postmedial fascia occurring at vein CuA2, the curved excavation between it and the anterior peak surrounding dark dots on veins M3 and CuA1 (Figs 1–11). The male genitalia show the generic features (Figs 12, 13, 15–24), but the aedeagus has a distinctive elongate-ovate vesica with moderate, rather broad cornuti in groups that may be basal or distal, either side of a central band of sclerotisation associated with the ductus ejaculatorius (Figs 25–34). The aedeagus apex has a spur or bifid process. The insertion of the ductus ejaculatorius on the aedeagus is at about one-quarter. In the female, the antevaginal plate is very broad, trapezoid (Figs 14, 35–46).



Figs 1–11. Habitus of *Bastilla* species. 1a,b, Two variants of *B. joviana*, male; 2, *B. vitiensis*, holotype, male; 3, *B. solomonensis*, male; 4, *B. myops*, lectotype, female; 5, *B. nielsenii*, holotype, male; 6, *B. subacuta subacuta*, holotype, male; 7, *B. subacuta juncta*, holotype, male; 8, *B. binatang*, male; 9, *B. cuneilineata*, male; 10, *B. duplicata*, paratype, female; 11, *B. flexilinea*, holotype, male. Scale bar: 5 mm.

The ductus is short, the corpus bursae with a centrally swollen basal section that is sclerotised and contains fields of small spines and a pyriform to spherical distal section that is finely scobinate.

The detailed treatment below focuses on the main *joviana*-group, in which the postmedial fascia is smoothly delineated. There is a further group of three species mentioned by Holloway (1983), where this fascia is



Figs 12–14. Genitalia of *Bastilla nielsenii*. 12, Aedeagus, lateral view; 13, male genitalia, ventral view, aedeagus removed; 14, female genitalia, ventral view.

additionally finely arcuate in the spaces between the veins. This group includes *B. dentilinea* (Bethune-Baker), comb. nov. (New Guinea) (Figs 45, 47, 48, 49), *B. marquesanus* (Collenette), comb. nov. (Marquesas), a large species noted by Holloway (1982: 235), and a similar large montane species from Tahiti, recently described (see below) as *Dysgonia insularum* Orhant, 2002, and here transferred to *Bastilla* as *B. insularum* (Orhant), comb. nov. A female in BMNH from the lowlands of Maïatea in the Tahiti group with facies and genitalia as in the typical *joviana*-group was originally referred to but not described in this text on the point of going to press. Dr A. Zilli notified the authors of its description as a subspecies of *B. solomonensis* by Orhant (2002) from a male and female from Mt Aorai, Tahiti. It is raised to specific rank following the treatment of *B. solomonensis* in the text below, but not illustrated. The name ‘*rectilimes*’ was proposed by Warren (1915: 151) as an aberration of ‘*dentilinea*’, but with a note that it ‘may probably prove [to be] a separate species’. The female holotype of *B. rectilimes* from Papua New Guinea in BMNH has a somewhat straighter inner border to the dark area of the forewing. W. W. Brandt (unpublished notes at ANIC) considered *B. rectilimes* a valid species, but this needs further investigation.

Holloway (1979: 470) made a preliminary survey of the *joviana*-group. The treatment below expands on this (new locality records confirmed by dissection are indicated by slide numbers), introduces three further described species, *B. flexilinea* (Warren), *B. subacuta* (Bethune-Baker), and *B. missionarii* (Hulstaert), and describes two new species, *B. nielsenii*, sp. nov. and *B. binatang*, sp. nov. Several have very similar facies and hence are best distinguished by reference to genitalic features.

***Bastilla joviana* (Stoll), comb. nov.**

(Figs 1a,b, 15a,b, 25, 35)

Phalaena Noctua joviana Stoll in Cramer, 1782: 237.

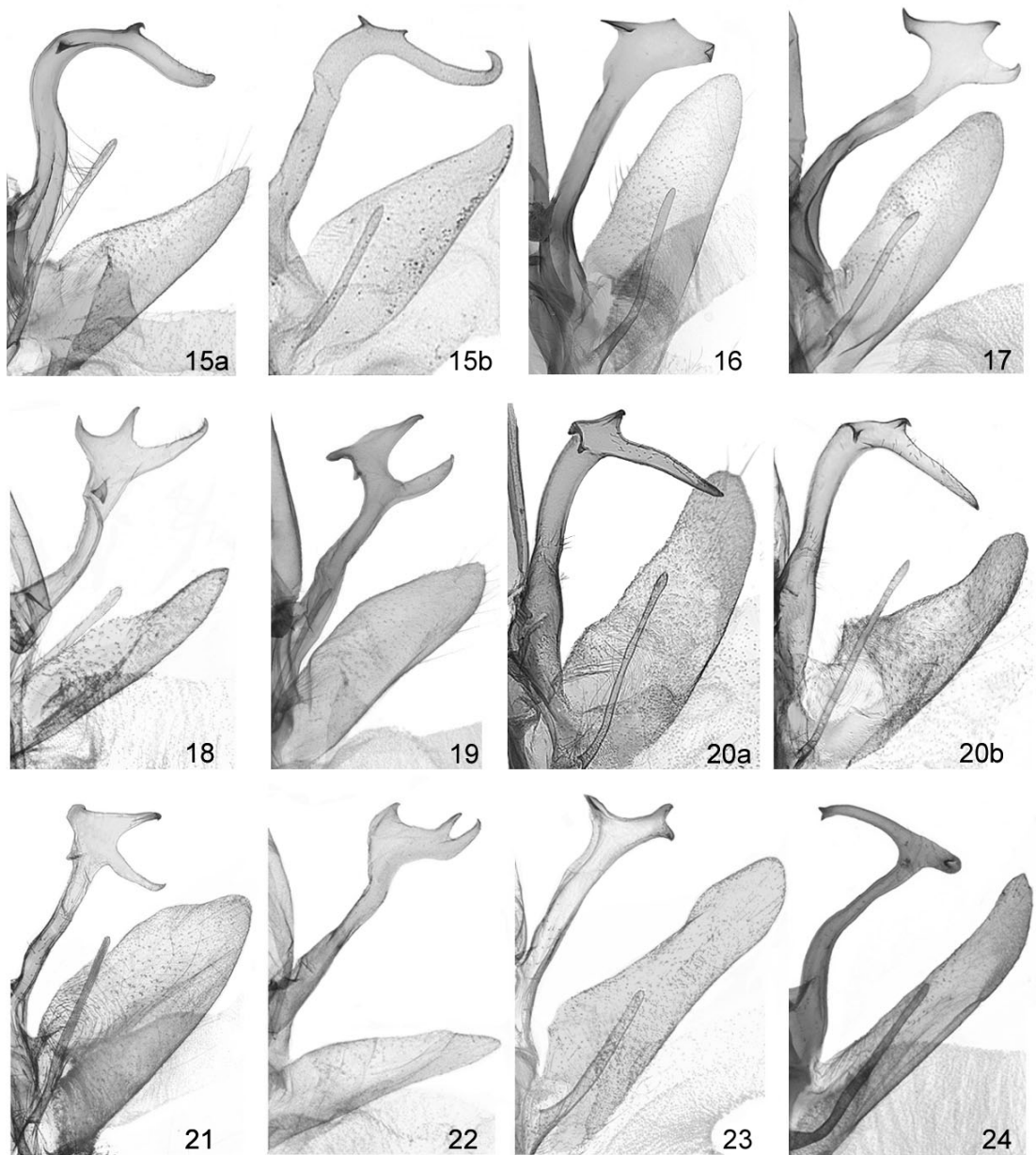
Noctua sinuata Fabricius, 1781: 507, preoccupied (see Poole 1989).

Dysgonia jovis Hübner, [1823] 1816: 269.

Parallelia curvisecta L.B. Prout, 1919: 185; **comb. nov., syn. nov.**

Diagnosis

The two peaks of the forewing postmedial fasciae are of approximately equal development, except at the eastern part of the range (see below). The dorsal process of the valve of the male genitalia is sinuous, tapering distally, rather than



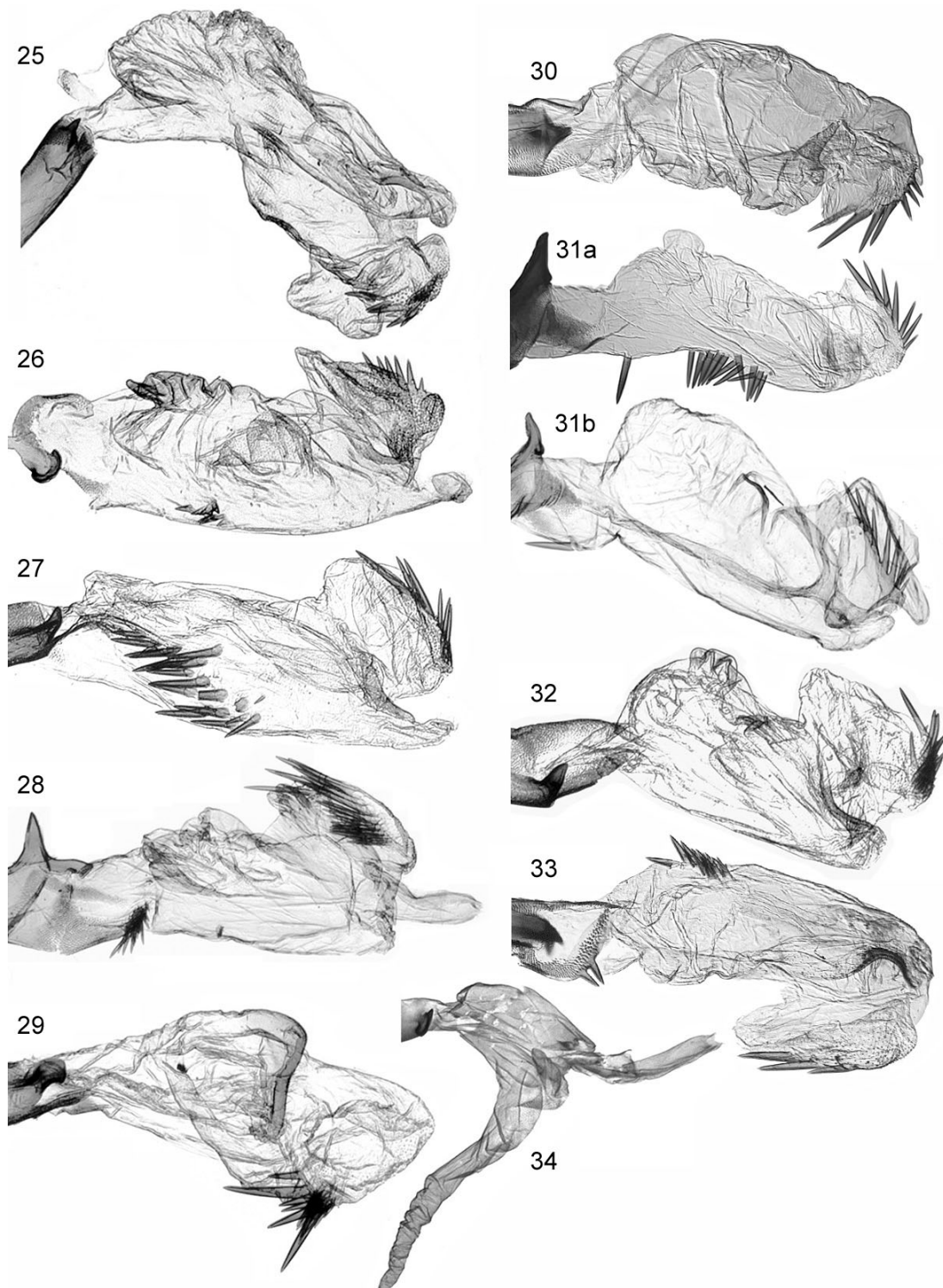
Figs 15–24. Ventral views of the costal processes of the valves of *Bastilla* species. 15a,b, Variants of *B. joviana*; 16, *B. vitiensis*; 17, *B. solomonensis*; 18, *B. myops*; 19, *B. nielsenii*; 20a,b, variants of *B. binatang*; 21, *B. subacuta*, holotype; 22, *B. cuneilineata*; 23, *B. duplicata*; 24, *B. flexilinea*, holotype.

expanded, with two lateral spines, variably separated, at about two-thirds. The aedeagus has a thumb-like apical process and the vesica has distal spining only. The female antevaginal plate is rather square, with oblique pleats in the anterior corners. The spining in the basal section of the corpus bursae increases from one-third to the distal end.

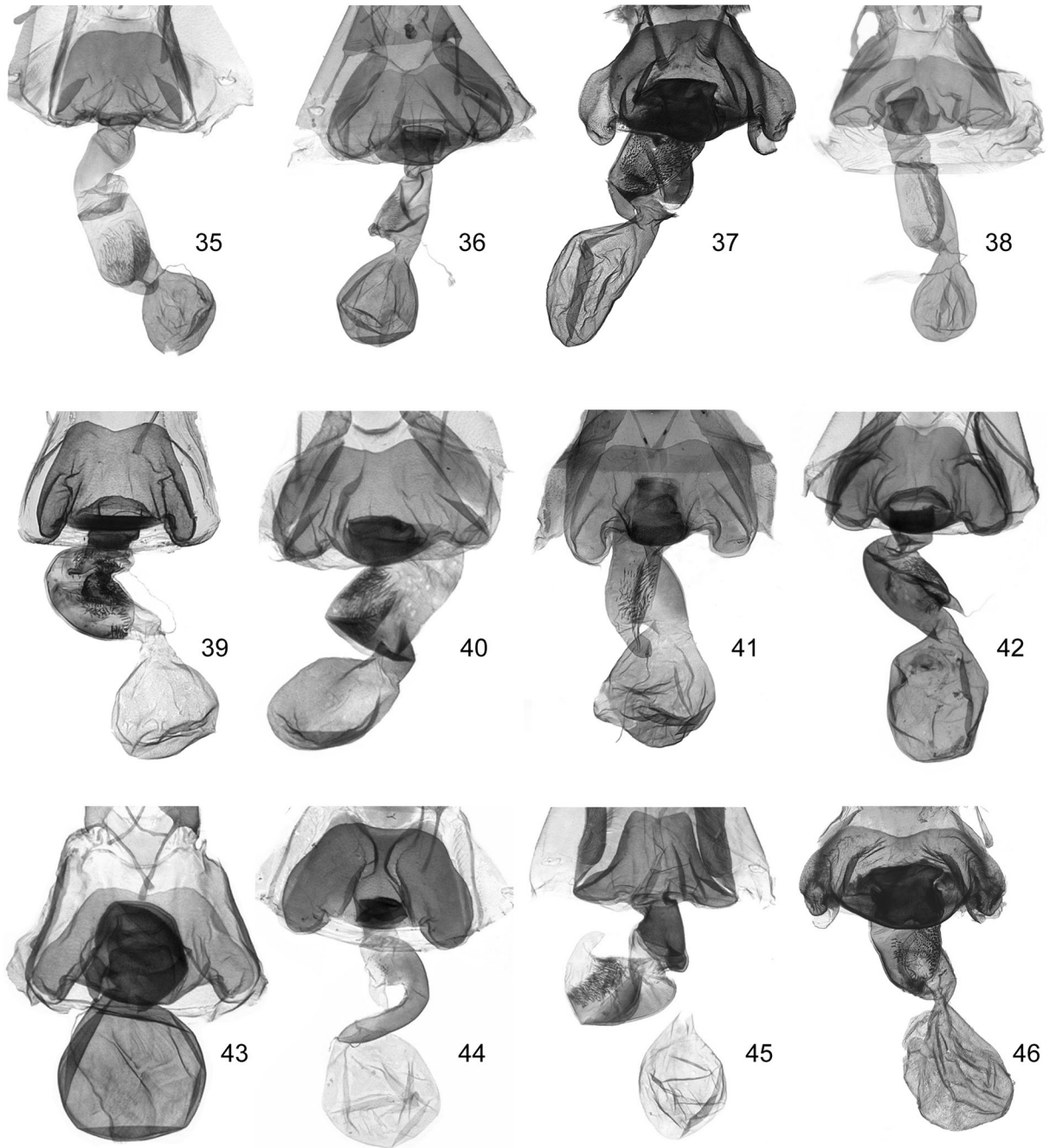
Holloway (1979) referred to a race of *B. joviana* from New Guinea and the Goodenough Is. in which the postmedial fascia was smoothly curved over its posterior part, lacking the second peak. The series is variable, with a

slight peak in some and also loss of the two dark dots in some of those with the smoothest postmedial curve. The taxon *curvisecta* Prout is based on an extreme example, with loss of the two dots. The male genitalia are similar to those of two other specimens in the series, having the two spines on the sinuous costal arm of the valve relatively close together. The race also occurs in Australia (Edwards 1996).

Distribution. Oriental tropics, Seram (slide BMNH 16572); New Guinea, Goodenough Is., Australia (north-eastern Queensland) (subspecies *curvisecta*, stat. nov.).



Figs 25–34. Lateral views of the vesicas of the male genitalia of *Bastilla* species. 25, *Bastilla joviana*; 26, *B. myops*; 27, *B. nielsenii*; 28, *B. cuneilineata*; 29, *B. duplicata*; 30, *B. vitiensis*; 31a,b, variants of *B. solomonensis*; 32, *B. subacuta*, holotype; 33, *B. binatang*; 34, *B. flexilinea*, holotype.



Figs 35–46. Ventral views of the sternigma, ductus and bursa of the female genitalia of *Bastilla* species. 35, *Bastilla joviana*; 36, *B. vitiensis*; 37, *B. solomonensis*; 38, *B. myops*; 39, *B. nielseni*; 40, *B. subacuta*; 41, *B. binatang*; 42, *B. cuneilineata*; 43, *B. duplicata*; 44, *B. flexilinea*; 45, *B. dentilinea*; 46, *B. missionarii*.

Bastilla vitiensis (Butler), comb. nov.

(Figs 2, 16, 30, 36)

Ophiusa vitiensis Butler, 1886: 414.

Parallelia prouti Hulstaert, 1924: 115; **comb. nov., syn. nov.**

Parallelia cuneifascia Hulstaert, 1924: 117; **comb. nov., syn. nov.**

Diagnosis

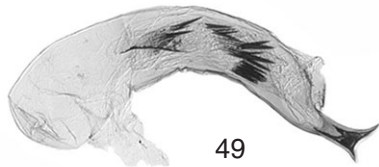
The posterior peak of the forewing postmedial fascia is consistently smaller throughout the range of the species. In the male genitalia, the costal process of the valve is rather broad and triangular at the apex as illustrated. The aedeagus



47



48



49

Figs 47–49. *Bastilla dentilinea*. 47, Habitus; 48, ventral view of the costal process of the valve; 49, aedeagus (cornuti visible but vesica not everted).

has a bifid process apically, the two spines reflexed; the vesica has a distal group of spines only. The female has the antevaginal plate slightly four-lobed because of slight concavity to the lateral and posterior margins; the lobes at the anterior corners appear slightly pouched. The ostium is enlarged to create almost a fifth anterior lobe. The spining in the basal section of the corpus bursae is to one side, broadening slightly to the distal end.

We have dissected the holotypes of *Parallelia prouti* (male) and *P. cuneifascia* (female) from Kei Island, now in RMNH, and find they match *B. vittensis*.



50

Fig. 50. Habitus of *Bastilla missionarii*, holotype.

Distribution. Fiji, Rotuma, Samoa, Tonga, Vanuatu, New Caledonia, Solomon Is., Bismarck Is., New Guinea, Kei Is. (holotypes of *P. prouti* and *P. cuneifascia*), North Moluccas, Sulawesi, Philippines (slides BMNH 16550, 16555), Borneo (slides BMNH 11206, 16556), Java (slide BMNH 16598).

***Bastilla solomonensis* (Hampson), comb. nov.**

(Figs 3, 17, 31*a,b*, 37)

Parallelia solomonensis Hampson, 1913: 572.

Parallelia joviana jovia Gaede (ex Strand), 1938: 485; **syn. nov.**

Parallelia solomonensis bicacuminata Holloway, 1979: 473.

Parallelia solomonensis hebridensis Holloway, 1979: 474.

Parallelia solomonensis papuana Holloway, 1979: 474.

Diagnosis

This is probably the most variable species in the group, both in the development of the two peaks of the forewing postmedial fascia (unequal as in *B. vittensis* in the type locality, but with the two peaks equal in size in New Caledonia and more westerly localities) and in the ornamentation of the aedeagus vesica (see Holloway 1979 and below). The costal process of the valve is apically trifid, with an exterior spine subapical to a rather flat apical bifurcation. The aedeagus apex has a slightly asymmetric bifurcation, with the margin between the spines rather flat. From the Bismarck Is. eastwards, the vesica has a distal group of spines and a single basal one. From New Guinea westwards there is also a central group of spines. However, this does not appear to be consistent in a reared series dissected from Madang, Papua New Guinea. The female genitalia are similar to those of *B. vittensis* in the antevaginal plate, but have a larger corpus bursae with a more irregular distribution of coarser spines in its basal section.

In Papua New Guinea, where it occurs sympatrically with *B. nielsenii* (see below), *B. solomonensis* has forewing postmedial peaks extending outward above and below the two spots (e.g. forming a concavity which envelopes the two

spots), and the male genitalia are distinctive in having three fingers on the costal process of the valve.

Distribution. Solomon Is. (incl. Rennell I.), Bismarck Is., New Caledonia (subspecies *bicacuminata*); Vanuatu (subspecies *hebridesia*); New Guinea, Australia – Queensland, Northern Territory, New South Wales (slides ANIC N411, N412, 3274) (subspecies *papuana*); Kei Is., Moluccas, Java (slide BMNH 16595) (subspecies *jovia*); Mindanao, Philippines (slide USNM 92659) (not assigned to subspecies).

Bastilla tahitiensis (Orhant), stat. nov. and comb. nov.

Dysgonia solomonensis tahitiensis Orhant, 2002: 31.

Diagnosis

This species is larger than *B. solomonensis* with a relatively broad dark band, the postmedial border having two rather irregular peaks, the more posterior shallower and rather rounded. The female has the medial border of the dark band less clearly defined, with the pale zone basal to it diffusing across it rather than terminating at it. The male genitalia have the apical part of the dorsal process closer to that of *B. nielsenii* than that of *B. solomonensis*, although the stem is sinuous as in *B. solomonensis* rather than straight, and the rest of the valve is oval as in *B. solomonensis* rather than tapering. The aedeagus vesica differs from both these species in lacking cornuti. The female (slide BMNH 17597) has the distal margin of the antevaginal plate more strongly bilobed than in any other species of the group; the ductus bursae is distinctly stepped on one side, and the spining in the basal part of the corpus bursae is light and restricted to a slight diverticulum that leads to the ductus seminalis. All these features indicate that *B. tahitiensis* merits species status because it lacks unambiguous synapomorphies with the races of *B. solomonensis* as well as possessing distinctive autapomorphies.

Distribution. Tahiti.

Bastilla myops (Guenée), sp. rev. and comb. nov.

(Figs 4, 18, 26, 38)

Ophiusa myops Guenée, 1852: 265.

Ophiusa myops var. *affinis* Guenée, 1852: 265.

Diagnosis

Poole (1989) placed this species as a synonym of *B. joviana*, which it resembles closely in facies. However, a female syntype from Java in BMNH (slide BMNH 11222) has genitalia that differ from those of *B. joviana*. It is probable that a male from Bali (slide BMNH 16557) is conspecific with this and both together represent a distinct species. We treat the dissected female syntype (BMNH noctuid slide 11222) as typical (*primus inter pares*) of *B. myops*. Another syntype and

type material of taxon *affinis* (also from Java) in the Boisdual Collection should be in the Muséum National d'Histoire Naturelle in Paris, but is apparently lost (Viette 1951). The status of *affinis* requires investigation: it may prove to be a senior synonym of *B. vitiensis* or *B. solomonensis*.

The male genitalia (Bali specimen) have the costal process of the valve distally trifid, the spines increasing in length exteriorly and there is also a fourth spine at the point where the apex begins to broaden. The aedeagus apex has a rather rounded process; the vesica has a distal row of spines and a central group opposite the sclerotisation of the ductus ejaculatorius. The female genitalia have the posterior margin of the antevaginal plate evenly curved. There are transverse puckers in the anterior corners and more longitudinal ones flanking the ostium. The basal section of the corpus bursae has spining along its length but not all around.

Distribution. Java, ?Bali.

Bastilla binatang, sp. nov.

(Figs 8, 20a,b, 33, 41)

Material examined

Holotype. Male, Papua New Guinea, Madang Province, Mis Village, 145°45'E, 5°11'S, collected as larva on *Phyllanthus lamprophyllus*, 19.xii.1996, Y. Basset *et al.* project specimen 59705, BMNH noctuid slide 18210.

Paratypes. Over 400 males and females reared during all months of the year during 1996 and 1997 from *Phyllanthus lamprophyllus* Muell. Arg. in four localities (Baitabag, Mis, Ohu and Pau) near Madang, all bearing the morphospecies assignment NOCT016. Some labels bear a misidentification of the host as *Phyllanthus hellwigii*.

Diagnosis

Males and females 15–19 mm. This species is distinctly smaller than other members of the *joviana*-complex and has a much more uniform forewing, the ground being a dark, rather violet, brownish grey. The peaks of the postmedial fascia are relatively shallow, the more posterior one particularly so, and the two dots are present but not conspicuous. The medial boundary of the dark band is diffuse (sharp in other species), and the antemedial line is straight with a slight but diagnostic sinuosity over the anterior half. The male genitalia have the costal process similar to that in the putative male of *B. myops*, except the distal spine of the trifid group is much longer, and the basal spine has the fourth spine wholly or partially fused with it. The aedeagus usually has a bluntly and shallowly bifid spur at the apex. The vesica has a distal row of four spines and a very basal single spine, but the most distinctive feature is a central process invested with numerous subsidiary spines; only some subspecies of *B. solomonensis* have a central group, and this is on the same side as any basal spines rather than opposite as in *B. binatang*. The female genitalia are similar to those of *B. cuneilineata*, but the antevaginal plate posterior margin is more flat.

Distribution. Papua New Guinea. Known only from the reared series.

Etymology. The name 'binatang', the Neomalesian word for insect, used as a noun in apposition, honours our parataxonomists, known locally as mangi binatang or insect men.

Bastilla subacuta (Bethune-Baker), comb. nov.

(Figs 6, 7, 21, 32, 40)

Ophiusa subacuta Bethune-Baker, 1906: 258.

Parallelia subacuta juncta A.E. Prout, 1922: 227; **comb. nov.**

Diagnosis

The dark zone between postmedial and medial fasciae is broad, owing to the shallowness of the posterior peak on the former and the slight curvature of the latter. The antemedial fascia is not parallel to the medial as in other species but has reverse curvature and has a darker zone basal to it such that there is a pale medial band that is narrow and centrally constricted. This pallor extends distally across the medial in some specimens (ab. *violaceo-media* Strand). In subspecies *juncta*, the central constriction of the medial band is often complete.

The apex of the costal process of the valve has four spines as in *B. myops* but they are arranged more in a square. The valves are broader. The neck of the uncus is distinctly longer and more evenly curved. The aedeagus apex has a single, acute process, and there is only a distal group of spines in the vesica. In the female, the antevaginal plate is more distinctly trapezoid, the posterior margin shallowly notched and the anterior one shallowly trilobed. The basal section of the corpus bursae has the zone of spining restricted to one side of the distal half.

Distribution. New Guinea; Seram (subspecies *juncta*).

Bastilla nielseni, sp. nov.

(Figs 5, 12, 13, 14, 19, 27, 39)

Material examined

Holotype. Male, Upper Aroa R., BRIT. N[EW] G[UINEA], April '03 (Meek), BMNH noctuid slide 16631.

Paratypes. Papua New Guinea, vicinity of Madang, reared from *Breynia cernua* (Poir.) Muell. Arg., with project specimen numbers as follows: males 57495, 59492, 59505, 59506, 62926, 63070, 68437, 100629; females 57594, 59201, 59503, 62480, 62832, 100630.

Diagnosis

Males and females 23–25 mm. This species is very similar in facies to specimens of *B. joviana*, *B. vitiensis* and *B. solomonensis* where the posterior peak is weaker than the anterior one. The dark area is somewhat broader and the two dark dots between the peaks are more clearly defined than in

most specimens of the other three species in localities where it flies with them. The paler areas of the wing have a violet tinge, and immediately basal to the curved medial there is a pale edging grading away basad that is relatively pronounced.

The male genitalia are similar to those of *B. subacuta*, but the apex of the valve costal process has the more basal of the interior spines closely associated with the more distal one, and the more basal of the exterior ones is distinctly broader. The aedeagus apex has a thumb-like apical process, and the vesica has a large group of spines basally (lacking in *B. subacuta*) as well as a distal row. The antevaginal plate of the female is similar to that of *B. subacuta*, but the zone of spining in the basal section of the corpus bursae extends along the whole of one side rather than being restricted to the distal half.

Given the difficulty in identifying the species reliably from external features, the type material is restricted to dissected specimens from New Guinea.

Distribution. New Guinea, Kei Is., Halmahera (Kampung Pasir Putih, 0°53'N, 127°41'E, 15–30.vi.1981, A.C. Messor & P.M. Taylor, Malaise trap in mangrove area, USNM slide 92657 male), North Queensland (3♂, 3♀, 10.12°S, 142.49°E Warraber (Sue) Is., slide N410; possibly also 1♀ from Bamaga, Cape York; all in ANIC), Bismarck Is. (New Britain), Solomon Is. (Tulagi I.). Edwards (1996: note 630) mentions the occurrence of this undescribed species in Australia.

Etymology. The species is named in memory of Ebbe S. Nielsen.

Bastilla cuneilineata (Warren), comb. nov.

(Figs 9, 22, 28, 42)

Ophiusa cuneilineata Warren, 1915: 153.

Diagnosis

The peaking of the postmedial fascia is diagnostically irregularly shaped and the distal edge of the trapezoid mark is obtusely notched (straight in other species); the dark zone between the medial and postmedial fasciae is paler, uniform with the forewing, in the majority of specimens. The medial fascia is less strongly curved, slightly sinuous. The male genitalia have the costal process of the valve with the apex bifid, with an interior spur separated from an apical bifurcation by a somewhat rectangular section. The apical process of the aedeagus is entire (Vanuatu) or bifid (New Caledonia), and the vesica has a distal row of cornuti and a patch of much smaller ones basally. The female has the antevaginal plate very strongly four lobed, the lateral lobes elongate and slightly pouched. The basal section of the corpus bursae has central and distal patches of spines on one side associated with the ductus seminalis.

Distribution. New Caledonia, Loyalty Is., Vanuatu.

Bastilla duplicata (Robinson), comb. nov.

(Figs 10, 23, 29, 43)

Parallelia duplicata Robinson, 1975: 178.*Diagnosis*

The dark zone of the forewing is rather broad, the postmedial fascia peaks somewhat irregular, though not to the extent of *B. cuneilineata*, where they are narrower. The male genitalia have the valve costal process somewhat similar to that of *B. cuneilineata*. The aedeagus has a rather spatulate apical process, and the vesica has a distal group of spines only. The female has the posterior corners of the trapezoid antevaginal plate produced into lobes anteriorly. There is only weak spining in the basal section of the corpus bursae (still folded in the specimen illustrated).

Distribution. Fiji.***Bastilla flexilinea*** (Warren), comb. nov.

(Figs 11, 24, 34, 44)

Ophiusa flexilinea Warren, 1915: 153.*Diagnosis*

The dark area between the antemedial and postmedial fasciae is similar to that of *B. duplicata*, but there is also a similarly dark basal zone, the two divided by a pale grey band. The trapezoid zone grades paler basad, and the postmedial fascia is also edged with a pale line. In the male genitalia the costal process of the valve is slender and distinctly T-shaped. The aedeagus has a rather small, laterally expanded apical spine, and the vesica is much more tapering than in the rest of the group, lacking major cornuti. The female has the antevaginal plate with ovate lateral lobes that extend along each side, and the basal section of the corpus bursae is narrow, curved, weakly spined at the basal end only, reflecting the shape of the male vesica.

Distribution. Solomon Is., including Bougainville (ANIC slide Brandt 65/451).***Bastilla missionarii*** (Hulstaert), comb. nov.

(Figs 46, 50)

Parallelia missionarii Hulstaert, 1924: 117.*Diagnosis*

This species is known only from the holotype female in RMNH. The forewing pattern is unusually uniform, including the area between the medial and two-peaked postmedial fasciae, which is also unusual in its broad contact with the dorsum. The shape of the subapical mark, particularly its sinuous boundary with the two-peaked area, is closest to that of *B. solomonensis*, perhaps the most variable of the species. Many *B. solomonensis* variants also

show reduction or loss of the dark dots between the two peaks. We do not know if the faint maculation is the result of post-mortem fading. The genitalia, particularly the shape of the antevaginal plate, are also more similar to those of *B. solomonensis* and *B. vitiensis* than to other members of the group. We consider it should be treated as distinct until further material from the type locality can be examined. We have not been able to locate further material in BMNH or USNM.

Distribution. Known only from the holotype from Olilit, Tenimber [Tanimbar], Indonesia.**Host-plant specialism**

The definition of what are most probably monophyletic groupings within the *Parallelia*-complex, *Achaea* and *Grammodes*, enables host-plant records to be reviewed in their light. Host records for the Old World tropics come from diverse sources and are of variable reliability. For example, records for plant taxa with soft fruit, such as *Citrus*, *Vitis* and *Malus*, as in Zhang (1994), may more probably refer to fruit piercing by the adult, a habit for which the Ophiusini are well known (Edwards 1978; Bänziger 1982; Holloway *et al.* 2001). Records for genera of soft fruit crop plants will therefore be excluded unless the larval stage is definitely referred to.

Many published and unpublished sources for such records have been noted by JDH in the parts published of the 'Moths of Borneo' monograph series and, more recently, G. S. Robinson has collected these and others together in a database and a published review for the Oriental region (HOSTS database, Robinson 1999; Robinson *et al.* 2001, 2003). Therefore, in the notes following, references will only be given if the record is not already collated in this database, such as for the New Guinea survey, or if it is questionable. Plant taxa are cited to genus-level only, except new records from the New Guinea survey.

Achaea

This genus feeds on a wide array of plant families, but with some preference for Euphorbiaceae. Moth species × plant genus incidences for each family of three and over for the African and Indo-Australian groupings as defined earlier are as follows.

African: Leguminosae (15); Euphorbiaceae (9); Myrtaceae (6); Rubiaceae (4); Anacardiaceae, Gramineae, Sapindaceae (3).

Indo-Australian: Euphorbiaceae (22); Leguminosae (20); Sapindaceae (9); Sapotaceae (6); Myrtaceae (4); Convolvulaceae, Lythraceae, Rosaceae (3).

In both areas, *Ricinus* is the most frequently used euphorb (4 species in the African group, 5 in the Indo-Australian one). *Euphorbia*, *Excoecaria*, *Phyllanthus* and *Sapium* are recorded for both groups, *Alchornea* and *Bridelia* are recorded for the African group only and *Acalypha*, *Aleurites*,

Andrachne, *Bischofia*, *Chamaesyce*, *Codiaeum*, *Croton*, *Flueggea*, *Jatropha*, *Manihot* and *Pedilanthus* are recorded for the Indo-Australian group, mostly for the highly polyphagous *A. janata* Linnaeus.

Grammodes

The widespread typical group has been recorded from a very wide range of plant families: Cistaceae, Coriariaceae, Ebenaceae, Euphorbiaceae, Fagaceae, Gramineae, Leguminosae, Linaceae, Polygonaceae, Rhamnaceae, Rosaceae, Smilacaceae, Tamaricaceae and Zygophyllaceae. No particular preference is shown for any of these, although the type species appears to be closely associated with Euphorbiaceae in Japan (Ohbayashi and Takeuchi 1996; Koshino 1999). Records for the Australian group are only from Euphorbiaceae as follows.

G. oculicola. *Glochidion*, *Phyllanthus* (Robinson 1975).

G. ocellata. *Phyllanthus* (Common 1990).

Parallelia

The type species has been recorded from Aceraceae, Betulaceae and Juglandaceae.

Macaldenia

Macaldenia palumba appears to be restricted to Rutaceae, such as *Atalantia*, *Citrus* and *Paramignya*. Some *Citrus* records (Yunus and Ho 1980), and one from *Vitis* (Vitaceae; Zhang 1994) may refer to adult fruit piercing.

Pindara

Records for two species are as follows.

P. illibata. *Bischofia* (Euphorbiaceae; Takeuchi and Obayashi 2000; Tanahara and Tanahara 2000); *Elaeocarpus* (Elaeocarpaceae; Tominaga 2001).

P. prisca. *Decaspermum* (Myrtaceae; Robinson 1975).

Pindara prisca (as *Parallelia anetica*) was recorded in a 1937 manuscript by R.H. Phillips from *Nelitris vitiensis*, which was cited as *Myrtus vitiensis* in Robinson (1975), but is now *Decaspermum fruticosum*.

Dysgonia

Records for the species included in the systematic section are from several families, but with some preference for Euphorbiaceae for *D. algira*, *D. stuposa* and *D. torrida*. The first has also been recorded from Leguminosae and Salicaceae. Records for this and other species from genera such as *Punica* (Lythraceae), *Ficus* (Moraceae), *Prunus* and *Rubus* (Rosaceae), *Citrus* and *Vitis* may refer to adult fruit piercing. Unusual records are for *D. latifascia* (Coriariaceae) and *D. constricta* (Elaeocarpaceae).

Bastilla

There are host records for all lineages mentioned in the earlier section and almost all are from Euphorbiaceae, particularly *Phyllanthus*. The interesting exceptions include records for Myrtaceae from Fiji (Browne 1968; Robinson 1975) to add to the one for *Pindara* noted above. Hinckley (1963) recorded *B. joviana* on *Eucalyptus robusta*, which was evidently reproduced by Browne (1968), but re-identified as *B. vitiensis* by Robinson (1975). Swezey (1942: 206) recorded *B. vitiensis* from Samoa on *Hibiscus tiliaceus* (Malvaceae). We have dissected Swezey's voucher in BPBM and confirmed the identification, but the host record is incorrect because it was collected as a mature caterpillar hiding 'under loose bark of *Hibiscus*'. Suspected adult records are in square brackets.

Typical group

B. absentimacula. *Phyllanthus* (Euphorbiaceae).

'*Caranilla*' sensu Berio-group.

B. angularis (Boisduval). *Phyllanthus*.

B. derogans (Walker). *Pinus* (Pinaceae).

B. palpalis (Walker). *Phyllanthus*.

B. proxima (Hampson). *Antidesma* (Euphorbiaceae).

B. simillima. *Phyllanthus*.

The smoothly arcuate *acuta*-group

B. amygdalis. *Phyllanthus*.

B. arcuata. *Glochidion* (Euphorbiaceae), *Phyllanthus*, [Citrus].

B. maturata. [*Vitis* (Vitaceae).]

The *joviana*-group

B. joviana. *Breynia* (Euphorbiaceae), *Phyllanthus*.

B. joviana curvisecta. *Acalypha* (Euphorbiaceae).

B. solomonensis. *Breynia* (also recorded in the New Guinea survey; *B. cernua* (Poir.) Muell. Arg.).

B. vitiensis. *Eucalyptus* (Myrtaceae; Browne 1968; Robinson 1975).

B. nielsenii. *Breynia cernua* (New Guinea survey).

B. binatang. *Phyllanthus lamprophyllus* Muell. Arg.

The *crameri*-group

B. analis. *Phyllanthus*.

B. crameri. *Phyllanthus*, *Sandoricum* (Meliaceae; noted as defoliating by Kuroko and Lewvanich 1993).

B. fulvotaenia. *Glochidion*.

B. praetermissa. *Phyllanthus*.

Buzara

This genus shows a similar focus on Euphorbiaceae to *Bastilla*, as follows.

B. frontinus. *Breynia*.

B. latizona. *Phyllanthus*.

B. onelia (incl. *umbrosa* (Walker)). *Phyllanthus*, *Sauropus* (Euphorbiaceae).

The African species, '*Parallelia*' *triplocyma*, stated earlier to be somewhat intermediate between *Bastilla* and *Buzara*, has also been recorded from *Phyllanthus*.

'*Parallelia*' *arctotaenia* feeds on *Quercus* (Fagaceae) in Japan.

Discussion

Genera in the *Parallelia*-complex and the related *Achaea* and *Grammodes* show a significant focus on Euphorbiaceae in their host-plant records. This contrasts with more distantly related genera, such as *Ophiusa* (particularly Myrtaceae and Combretaceae; Holloway 1979) and the open habitat *Mocis* Hübner and *Trigonodes* Guenée-complex (Gramineae and Leguminosae).

Three lineages show a much stricter specialism: the Australian group in *Grammodes*; *Bastilla* and *Buzara* in the *Parallelia*-complex. The last two genera share the doubling of the coremata in the male genitalia. This is also seen in the somewhat intermediate '*P.*' *triplocyma*, also on Euphorbiaceae, so it is possible that all three form a monophyletic group, although *Dysgonia* shares facies features with *Bastilla* and has genitalia more similar to *Buzara*. The situation is not clear-cut and needs further, more detailed study than has been possible in this preliminary skirmish.

The specialist lineages favour the euphorb genera *Phyllanthus*, *Breynia* and *Glochidion* in particular. *Breynia* extends no further east than Fiji, but the other genera are widely distributed in Polynesia (Van Balgooy 1971) and are therefore available as hosts for Polynesian taxa in the *joviana*-group.

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