Revision of the Australian Andini (Hemiptera: Fulgoromorpha: Cixiidae) with a description of five new species

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Abstract

Andini, a tribe comprising two genera, Andes Stål, 1866 and Parandes Muir, 1925, is primarily distributed through the tropical and subtropical regions of South East Asia, Australia and Africa. One species, Andes migratorius (Distant, 1907), was previously known from Australia, the following five Australian species are herein described as new: Andes dossenus sp. nov., A. ikelus sp. nov., A. lamondensis sp. nov., A. moaensis sp. nov. and A. turrondi sp. nov. Lectotypes are designated for Brixia migratoria Distant, 1907 and Leirioessa tortricomorpha Kirkaldy, 1907. Maps of the known distribution for each species are given and the close links between the Australian and Asian fauna are discussed.

Key words: Auchenorrhyncha, Fulgoroidea, planthopper, morphology, distribution, Andes, Australia

Introduction

The planthopper family Cixiidae comprises more than 150 genera and 2000 species worldwide (Holzinger et al. 2002). Some cixiids are economically important due to their ability to transmit plant phytoplasma diseases (Alma 2002, Liefting et al. 1998, Maixner et al. 1995) or plant pathogenic bacteria (Danet et al. 2003). The tribe Andini Emeljanov 2002, represented by the genera Andes Stål, 1866 and Parandes Muir, 1925, is one of the smaller tribes within Cixiidae.

Parandes is monotypic with Parandes simplus Muir, 1925 from West Borneo whereas more than 100 species are described within the genus Andes. The two genera differ in the shape and size of the front coxae, which are straight in Andes and produced and rounded on the outer edge of the apical half in Parandes. Andes primarily occurs in the tropical and subtropical regions of South East Asia, Australia and Africa. Major contributors to the knowledge of the genus were Distant (1907, 1911), Fennah (1956, 1957, 1978, 1985), Muir (1921, 1922, 1925b, 1926), Synave (1953a, 1953b, 1960, 1967) and Van Stalle (Van Stalle 1982, 1983, 1984a, 1984b, 1985, 1986; Van Stalle & Synave, 1984).

In 1907, two Australian species, Brixia migratoria Distant, 1907 and Leirioessa tortricomorpha Kirkaldy, 1907, were described from specimens collected in Queensland. Kirkaldy (1907) characterised the genus Leirioessa Kirkaldy, 1907 as “Apparently allied to Brixia, but the vertex is broader than an eye and well produced anteriorly. Antennae not exserted, second segment globular. Pronotum of very different structure. Tegmina apically rounded, distinctly widening towards the apex. Hind tibiae with three larger and sometimes one or two smaller spines.” Leirioessa was made a junior synonym of Andes by Muir (1925b) so that Leirioessa tor-
tricomorpha became Andes tortricomorphus. Muir (1925b) also transferred Brixia migratoria into Andes as Andes migratorius (Distant). Jacobi (1928) synonymised the two Australian species, but rejected the placement within Andes based on the fact that in Kirkaldy’s drawing of the forewing of Andes tortricomorpha (Kirkaldy 1907: Plate 27, Figure 21) Subcosta, Radius and Media do not arise separately from the basal cell but form a common stem. He stated that a specimen from Malanda which he had examined had an even longer common stem. Based on this, Jacobi (1928) concluded that the specimen illustrated by Muir (1925b) as Andes tortricomorpha was misidentified and Leirioessa tortricomorpha = migratoria could not be congeneric with Andes. Holzinger et al. (2002) synonymised Leirioessa with Andes thereby transferring L. migratoria back to Andes. We have accepted this synonymy based on reasons given in the discussion section of this paper.

Materials & Methods

Preparation of male genitalia

Male specimens were softened and dissected following the protocol described by Löcker et al. (2006).

Measurements

The morphological terms applied here are as used by Löcker et al. (2006) and illustrated in Fig. 4A, except for the nomenclature applied in this paper to the venation of the tegmen, which follows Anufriev & Emeljanov (1988), and differs slightly from that applied in Löcker et al. (2006).

The following measurements were taken in this study:

• body length: tip of head to tip of forewing
• width of vertex: width level with tip of basal emargination
• length of vertex: subapical transverse carina to tip of basal emargination
• length of frons: apical transverse carina to frontoclypeal suture, in median line
• width of frons: at level of frontoclypeal suture
• width of forewing: at level of apex of clavus
• length of forewing: base to tip of wing

Abbreviations

AMS Australian Museum, Sydney
ANIC Australian National Insect Collection, CSIRO, Canberra
BMNH Natural History Museum, London
BPBM Bishop Museum, Honolulu, Hawaii
LBOB Lois O’Brien private collection, USA
MAGD Northern Territory Museum, Darwin
NSW New South Wales
NT Northern Territory
NTDPI Northern Territory Department of Primary Industries, Darwin
QDPC Queensland Department of Primary Industries, Brisbane
Qld Queensland
UQIC University of Queensland Insect Collection, Brisbane.
Genus *Andes* Stål

*Andes* Stål, 1866: 166. Type species *Andes undulata* Stål 1870, subsequent designation by Muir (1925b).

*Leirioessa* Kirkaldy 1907: 112, synonymised by Muir 1925b: 201. Type species *Leirioessa tortricomorpha* Kirkaldy (1907), by original designation.

Remarks. The genus *Andes* was described by Stål in 1866, however he did not describe a species within this genus until 1870.

**Colour.** Vertex brown with two longitudinal white stripes; frons brown, lateral carinae paler, sometimes with brown dots; body brown; forewings hyaline, colourless, with two brown transverse bands (tb1, tb2) (Figs 1A, 1F, 2A, 2F, 3A, 3F) and scattered brown marks; median ocellus often reddish.

**Morphology.** Body length: ♂ 3.8–6.6 mm.

**Head.** Vertex with u- or v-shaped basal emargination; lateral carinae strongly elevated; median carina absent; apical transverse carina well developed; subapical transverse carinae weakly developed. Maximum width of frons more than 2 x apical width, steadily broadening; position of maximum width distinctly dorsad of centre of frontoclypeal suture; lateral carinae strongly elevated; frontoclypeal suture slightly semicircular bent upwards, median part not reaching lower margin of antennal scape; median ocellus present. Median and lateral carinae of postclypeus well developed; median carina of anteclypeus well developed; lateral carinae absent.

**Thorax.** Pronotum with hind margin rectangular to slightly obtusely angled. Mesonotum with 3 well developed carinae. Forewing in resting position steeply tectiform, apices of wings touching; costal margin slightly outwardly convex basally; tubercles present along veins; Sc+R+M arising separately from a common point on the basal cell or forming a minute common stem (less than 3 x diameter of tubercle); position of r-m at same level as (rarely slightly basad of) fork MA+MP; icu distinctly distad of apex of clavus; RP apically trifid; MA apically trifid; MP apically bifid; fork of CuP+1A central within clavus (rarely basad or distad of centre of clavus); 10 apical cells. Fore leg: coxa with outer margin straight, subparallel with inner margin, not produced. Hind leg: tibia with 6 apical teeth forming uninterrupted row of spines (rarely small gap present, dividing spines in two groups of three teeth); tarsomeres without platellae; 2nd tarsomere with 1–4 very fine setae underneath row of apical teeth.

Remarks. The following attribute distinguishes the Australian *Andes* from all other Australian cixiid genera, Sc+R+M arising separately from a common point on the basal cell or forming a minute common stem (less than 3 x diameter of a tubercle).

Distribution. Palaearctic Region, Afrotropical Region, Oriental Region, Australian Region (New South Wales, Northern Territory, Queensland).

Key to Australian species of *Andes* Stål

1. Lateral carinae of frons pale with large brown dots (Figs 1C, 3C); shape of genital styles as in Figs 4F, 8D ..............................................................................................................................................................2
   - Lateral carinae of frons pale without dots (Figs 1E, 2C,E, 3E); shape of genital styles not as above.....3
2(1) Cucullus of aedeagus (Fig. 4A) in left lateral view with a pointed rim as in Fig. 4A; phallotheca left laterally without ridges (Fig. 4A) ............................................................................................................. A. *dosenus* Löcker, sp. nov.
   - Cucullus of aedeagus in left lateral view with a rounded rim as in Fig. 8A; phallotheca left laterally with a long flattened ridge bearing a smaller elliptic ridge as in Fig. 8A ............. A. *moaensis* Löcker, sp. nov.
3(1) Forewing with transverse band (tb1) narrow, yellowish to light brown, at least one pterostigma length basad of pterostigma (Fig. 1F); genital styles apically rounded with a tapering process as in Fig. 5F; aedeagus with numerous pointed, flattened processes as in Figs 5A,B ............. A. *ikelus* Löcker, sp. nov.
Forewing with transverse band (tb1) wide, mid to dark brown, immediately basad of pterostigma (Figs 2A,F, 3F); genital styles rounded without process (Figs 6E, 7G, 9F); aedeagus without pointed flattened processes (Figs 6A, 7A,B, 9A,B) .................................................................4

4(3) Rim of cucullus smooth as in Fig. 7A; shape of cucullus narrow as in Fig. 7A................................................................. A. migratorius (Distant, 1907)

- Rim of cucullus distinctly serrated as in Figs 6A, 9A; shape of cucullus moderately wide to very wide as in Figs 6A, 9A ................................................................................................................. ..........................5

5(4) Cucullus very wide, covering all or most of flagellum in lateral view (Fig. 9A); shape of cucullus in lateral view as in Fig. 9A................................................................................................................................. A. turrondi Löcker, sp. nov.

- Cucullus not as wide, only partly covering flagellum in lateral view (Fig. 6A); shape of cucullus in lateral view as in Fig. 6A A. lamondensis Löcker, sp. nov.

Andes dossenus Löcker, sp. nov.
(Figs 1A–C, 4)


Etymology. The species name is the Latin word for clown and refers to the spotted colouring on the face.

Colour. Vertex mid or dark brown with two longitudinal, white stripes; frons mid or dark brown, lateral carinae paler, with distinct mid to dark brown dots; pronotum light brown; mesonotum light or mid brown; legs light brown; forewing hyaline, colourless, with transverse band (tb1) narrow, weakly developed, brown, basad of pterostigma, covering fork CuA1+CuA2 and terminating at CuP, forewing with transverse band (tb2) narrow, weakly developed, brown, around basal cell reaching into clavus, forewing sometimes with light brown marks scattered across wing, veins concolorous with cells, tubercles mid brown, pterostigma light brown; abdominal sternites light or mid brown.

Morphology. Body length: ♂ 3.8–4.7 mm, ♀ 4.8–5.7 mm. Head: Vertex 0.5–0.8 x as long as wide. In lateral view, vertex and frons forming curve, head at junction of vertex and frons no more than slightly produced. Frons 2.6–3.7 x longer than wide; median carina incomplete, covering 1/4 to 1/2 of length of frons; lateral carinae no more than slightly extending laterally, no more than partly concealing base of antennae; median ocellus separated from frontoclypeal suture by no more than its own diameter. Rostrum distinctly surpassing hind coxae.

Thorax: Forewing 2.7 x longer than wide; CuA1+CuA2 forking 1/3–1/4 away from apex of clavus; costa with 11–16 tubercles. Hind leg: tibia with 2–4 small to medium sized lateral spines; 1st tarsomere with 7–9 apical teeth; 2nd tarsomere with 7–8 apical teeth and 2–3 very fine setae underneath row of apical teeth.

Male genitalia: Anal tube as in Figs 4D–E; genital styles and ventromedian process as in Figs 4F–G. Aedeagus (Figs 4A–C); phallotheca with long, moderately wide cucullus, shaped as in Fig. 4A, lower rim of cucullus slightly serrated, in left lateral view pointed (Fig. 4A); flagellum unarmed; virga elongated, sinuate.

Remarks. Andes dossenus shares the spotted colouring on the face with A. moaensis. It differs from A. moaensis in the shape of the cucullus and the absence of ridges on the phallotheca.
Andes ikelus Löcker, sp. nov.
(Figs 1D–F, 5)

Types. Holotype, ♂, AUSTRALIA, Qld: “National Bridge” [could be Natural Bridge, 28.13S, 153.14E], 24.i.1961 (J.L. Gressitt) (BPBM 16628), Paratype, AUSTRALIA, Qld: 1 ♂ or ♀, same data as holotype (BPBM).

Etymology. The Greek term “ikelos” means “like”. This species resembles Andes distinctus Muir (1925) from Borneo (see Remarks below).

Colour. Vertex light brown with two longitudinal white stripes; frons light brown without brown dots; pronotum light brown; mesonotum light to mid brown; legs light brown; forewing hyaline, colourless, with transverse band (tb1) narrow, yellowish to light brown, at least one pterostigma length basad of pterostigma, covering fork CuA1+CuA2 or passing slightly distad and terminating at CuP, forewing with transverse band (tb2) narrow, weakly developed, yellowish to light brown, along CuP, forewing with brown marks near icu and fork MA1+MA3, veins concolorous with wings, tubercles and pterostigma light brown; abdominal sternites light to mid brown.

Morphology. Body length: ♂ 5.9 mm.

Head: Vertex 0.8 x as long as wide. In lateral view, vertex and frons forming curve, head at junction of vertex and frons not produced. Frons 3.6 x longer than wide; median carina incomplete, covering about 1/4 of length of frons; lateral carinae not extending laterally, not concealing base of antennae; median ocellus separated from frontoclypeal suture by more than its own diameter. Rostrum slightly surpassing hind coxae.

Thorax: Forewing 2.6 x longer than wide; CuA1+CuA2 forking 1/3 away from apex of clavus; costa with 20 tubercles. Hind leg: tibia with 6 small to medium sized lateral spines; 1st tarsomere with 8 apical teeth; 2nd tarsomere with 7 apical teeth.

Male genitalia: Anal tube as in Figs 5C–D; genital styles and ventromedian process as in Figs 5E–F. Aedeagus (Figs 5A–B): phallotheca without cucullus, with numerous flattened processes as in Figs 5A–B; flagellum unarmed; virga elongated, sinuate.

Remarks. This species shares the external appearance, in particular the colouration of the wing and head, the shape of the genital styles and the general structure of the aedeagus, of Andes distinctus Muir (1925) from Sandakan, Malaysia (holotype examined). However, A. distinctus varies in the shape and presence of certain flattened processes on the aedeagus. The overall shape of the genital styles is further shared with Andes siberutensis Muir (1926) from Siberut, Indonesia. The latter has a number of rounded spines on the aedeagus whereas A. ikelus and A. distinctus are characterised by flattened spines on the aedeagus.

Andes ikelus can be distinguished from all other Australian Andini by the presence of numerous flattened processes on the phallotheca and the absence of a cucullus.

Andes lamondensis Löcker, sp. nov.
(Figs 2A–C, 6)


Etymology. This species is named after the type locality Claudie River near Mt Lamond in northern Queensland.

Colour. Vertex light or mid brown with two longitudinal, white stripes; frons mid or dark brown, lateral carinae paler, without dots; pronotum light brown; mesonotum light to mid brown; legs light brown; forewing...
hyaline, colourless, with transverse band (tb1) wide, mid to dark brown, extending to immediately basad of pterostigma, covering fork CuA1+CuA2 and terminating at CuP, forewing with transverse band (tb2) narrow, mid to dark brown, around basal cell reaching into clavus, forewing with mid or dark brown marks scattered across wing, apical half of wing with light brown patches; veins concolorous with cells, tubercles mid brown, pterostigma light brown; abdominal sternites light or mid brown.

**Morphology.** Body length: ♂ 5.6 mm, ♀ 6.1 mm.

**Head:** Vertex 0.8 x as long as wide. In lateral view, vertex and frons forming curve, head at junction of vertex and frons slightly or distinctly produced. Frons 3.0–3.2 x longer than wide; median carina incomplete, covering 1/3 to 1/2 of length of frons; lateral carinae not extending laterally, not concealing base of antennae; median ocellus separated from frontoclypeal suture by less than its own diameter. Rostrum distinctly surpassing hind coxae.

**Thorax:** Forewing 2.3–2.6 x longer than wide; CuA1+CuA2 forking 1/5–1/6 away from apex of clavus; costa with 16–17 tubercles. Hind leg: tibia with 6 small to medium sized lateral spines; 1st tarsomere with 8–9 apical teeth; 2nd tarsomere with 7–8 apical teeth and 2–3 very fine setae underneath row of apical teeth.

**Male genitalia:** Anal tube as in Figs 6B–C; genital styles and ventromedian process as in Figs 6D–E. Aedeagus (Fig. 6A): phallotheca with long, wide cucullus, shaped as in Fig. 6A, lower rim of cucullus conspicuously serrated, in left lateral view straight, oblique (Fig. 6A); flagellum unarmed; virga elongated, sinuate.

**Remarks.** The proportions and shape of the cucullus in combination with the conspicuously serrated rim of the cucullus are diagnostic for this species.

**Andes migratorius** (Distant)
(Figs 2D–F, 7)

*Brixia migratoria* Distant 1907: 279.
*Leirioessa tortricomorpha* Kirkaldy 1907: 112 (Plate 8, Figs 19–21), synonymised by Jacobi 1928: 35.
*Andes tortricomorphus* (Kirkaldy), Muir 1925: 222 (Plate 2, Fig. 28).
*Andes migratorius* (Distant), Muir 1925: 223.
*Leirioessa migratoria* (Distant), Jacobi 1928: 35.
*Andes migratorius* (Distant), Holzinger et al. 2002: 124.

**Types.** Lectotype of *Brixia migratoria* here designated, ♂, AUSTRALIA, Qld: F.P. Dodd (BMNH). Lectotype of *Leirioessa tortricomorpha* here designated, ♂, AUSTRALIA, Qld: Kuranda, viii.1904 (BPBM). Paralectotype: AUSTRALIA, Qld: 1 ♀, Cairns, viii.1904 (BPBM).

**Remarks.** Distant’s (1907) original description of *Brixia migratoria* does not specify whether the type series consists of more than one specimen. Only one specimen has been found in the BMNH and it is here designated as lectotype in order to clarify the identity of the species. A lectotype and paralectotype for *Leirioessa tortricomorpha* are here designated to give a diagnostic reference for that name. Holzinger *et al.* (2002: 124) listed *Leirioessa* as a synonym of *Andes* without listing the included species.

**Other material examined.** AUSTRALIA, NSW: 1 ♂, Lorien Refuge, 3km N Lansdowne nr Taree, rainforest margin, malaise trap, 23–30.i.1987 (G. Williams) (ASCU), 1 ♀, same data, 9.–15.i.1987 (ASCU), AUSTRALIA, Qld: 5 ♂, 3 ♀, 1 ♂ or ♀ (abdomen missing), State Forest near Caloundra Turnoff, SE.Qld, 8.i.1984 (I.D. Galloway) (QDPC), 1 ♂, 1 ♀, Cairns (CAS), 1 ♂, 22 [miles] SW Ingham, 30.v.1961 (R. Straatman) (ANIC), 1 ♂, Camp Mountain, SE.Qld, malaise trap, open sclerophyll gully, 29.xii.1979–7.i.1980 (Marks) (QDPC), 3 ♂, 1 ♀, 11 km W Caloundra, 11.xi.1989 (C.W. & L.B. O’Brien) (LBOB), 1 ♂, 1 ♀, Mt Windsor Tableland Forestry Hut, 16.15.42S 145.02.25E, 1060m, pans, 16.–17.iv.1994 (D. Bickel) (AMS), 1
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Aedes moaensis Löcker, sp. nov.
(Figs 3A–C, 8)


Etymology. This species is named after the type locality Moa Island in northern Queensland.

Colour. Vertex mid or dark brown with two longitudinal, white stripes; frons mid brown, lateral carinae paler, with distinct dark brown dots; pronotum light brown; mesonotum light to mid brown; legs light brown; forewing hyaline, colourless, with transverse band (tb1) sometimes weakly developed, brown, extending to basad of pterostigma, covering fork CuA1+CuA2 and terminating at CuP, forewing with transverse band (tb2) sometimes weakly developed, narrow, brown, around basal cell reaching into clavus, forewing sometimes with brown marks scattered across wing, veins concolorous with cells, tubercles mid brown, pterostigma light brown; abdominal sternites light or mid brown.

Morphology. Body length: ♂ 5.4–5.5 mm, ♀ 6.5 mm.

Head: Vertex 0.5–0.6 x as long as wide. In lateral view, vertex and frons forming curve, head at junction of vertex and frons not produced. Frons 2.7–2.9 x longer than wide; median carina incomplete, covering 1/3 to

Aedes brunneus Muir (1925) and A. indistinctus Muir (1925) from Borneo. In A. brunneus, however, the cucullus is smaller, covering only the apical third of the phallotheca, whereas in A. migratorius half to 3/4 of the phallotheca is covered by the cucullus. Aedes indistinctus differs from A. migratorius in the shape of the anal tube, which bears a triangular process with an acute apex on its apical lobes. Aedes migratorius can be distinguished from all other Australian Andini by the unique combination of a long, very slender cucullus and an unspotted face.

Aedes moaensis Löcker, sp. nov.
(Figs 3A–C, 8)


Etymology. This species is named after the type locality Moa Island in northern Queensland.

Colour. Vertex mid or dark brown with two longitudinal, white stripes; frons mid brown, lateral carinae paler, with distinct dark brown dots; pronotum light brown; mesonotum light to mid brown; legs light brown; forewing hyaline, colourless, with transverse band (tb1) sometimes weakly developed, brown, extending to basad of pterostigma, covering fork CuA1+CuA2 and terminating at CuP, forewing with transverse band (tb2), sometimes weakly developed, narrow, brown, around basal cell reaching into clavus, forewing sometimes with brown marks scattered across wing, veins concolorous with cells, tubercles mid brown, pterostigma light brown; abdominal sternites mid brown.

Morphology. Body length: ♂ 5.4–5.5 mm, ♀ 6.5 mm.

Head: Vertex 0.5–0.6 x as long as wide. In lateral view, vertex and frons forming curve, head at junction of vertex and frons not produced. Frons 2.7–2.9 x longer than wide; median carina incomplete, covering 1/3 to
1/2 of length of frons; lateral carinae not extending laterally, not concealing base of antennae; median ocellus separated from frontoclypeal suture by less than its own diameter. Rostrum slightly or distinctly surpassing hind coxae.

Thorax: Forewing 2.6–2.7 x longer than wide; CuA1+CuA2 forking 1/3 away from apex of clavus; costa with 14–18 tubercles. Hind leg: tibia with 3 small to medium sized lateral spines; 1st tarsomere with 8 apical teeth; 2nd tarsomere with 8 apical teeth and 3 very fine setae underneath row of apical teeth.

Male genitalia: Anal tube as in Figs 8B–C; genital styles and ventromedian process as in Figs 8D–E. Aedeagus (Fig. 8A); phallotheca with long, very slender cucullus, shaped as in Fig. 8A, rim of cucullus smooth; phallotheca left lateral with a long, flattened ridge; flagellum unarmed; virga elongated, sinuate.

Remarks. *Andes moaensis* can be distinguished from all other Australian Andini by the combination of the frons with distinct dark brown dots and the phallotheca with a long flattened ridge.

**Andes turrondi** Löcker, sp. nov.
(Figs 3D–F, 9)


Etymology. “Turrondi” means “to saw” in Kaurna, a language spoken by Aboriginal people living in the Adelaide Plains (Thieberger & McGregor 1994). This species is named after the serrated rim of the cucullus.

Colour. Vertex mid brown with two longitudinal, white stripes; frons mid to dark brown, lateral carinae paler, without dots; pronotum light brown; mesonotum light to mid brown; legs light brown; forewing hyaline, colourless, with transverse band (tb1) wide, mid to dark brown, extending to immediately basad of pterostigma, covering fork CuA1+CuA2 and terminating at CuP, forewing with transverse band (tb2) narrow, mid to dark brown, around basal cell reaching into clavus, forewing with mid or dark brown marks scattered across wing, apical half of wing with light brown patches; veins concolorous with cells, tubercles mid brown, pterostigma light brown; abdominal sternites light or mid brown.

Morphology. Body length: ♂ 4.7–5.5 mm, ♀ 5.7–6.7 mm.

Head: Vertex 0.5–0.8 x as long as wide. In lateral view, vertex and frons forming curve, head at junction of vertex and frons no more than very slightly produced. Frons 2.5–3.8 x longer than wide; median carina incomplete, covering about 1/2 of length of frons; lateral carinae not extending laterally, not concealing base of antennae; median ocellus separated from frontoclypeal suture by less than its own diameter. Rostrum slightly surpassing hind coxae.

Thorax: Forewing 2.4–2.6 x longer than wide; CuA1+CuA2 forking 1/5–1/6 away from apex of clavus; costa with 13–16 tubercles. Hind leg: tibia with 3–5 small to medium sized lateral spines; 1st tarsomere with 8 apical teeth; 2nd tarsomere with 8 apical teeth and 1–4 very fine setae underneath row of apical teeth.

Male genitalia: Anal tube as in Figs 9C–D; genital styles and ventromedian process as in Figs 9E–F. Aedeagus (Figs 9A–B); phallotheca with long, very wide cucullus, distinctly curved in left lateral view (Fig. 9A), lower rim of cucullus conspicuously serrated; flagellum unarmed; virga elongated, sinuate.

Remarks. The proportions and shape of the cucullus in combination with the conspicuously serrated rim of the cucullus are diagnostic for this species.
Discussion

Our investigations of the Australian material of Andini showed that the Subcosta, Radius and Media veins either form a minute common stem (about the length of less than 3 x the diameter of a tubercle) or they arise separately from a common point on the basal cell and thus do not form a common stalk. In some cases both character states appeared on different wings of the same specimen. The male lectotype of *Andes tortricomorpha* has only one forewing present and, on this, all three veins arise from a common point on the basal cell. It is, however, unclear whether Kirkaldy’s illustration was based on this particular specimen (and wing). From Kirkaldy’s illustration it is impossible to determine which of the two states is present: arising separately from one point, or a minute stem (in this case about the length of 1 tubercle diameter). Muir’s definition of *Andes* includes the state arising from one point but does not mention the occurrence of a minute stem. Nevertheless, due to the variability of this character within each species and even within both wings of the same specimen, the fact that the common stem, if present, is minute and the observation that the types of *Leirioessa migratoria* and *L. tortricomorpha* match the description of *Andes* as recognised here, we confirm *Leirioessa* as a junior synonym of *Andes* as first proposed by Muir (1925b).

Muir (1925b) gives the following character state in his description of *Andes*, “Cu forks about one-third from apex of clavus ...”. This state is present in the Australian species of *A. ikelus* and *A. moaensis*. In *A. dossenus* Cubitus Anterior (CuA) forks about 1/3–1/4 from apex of clavus, whereas in *A. turrondi*, *A. migratorius* and *A. lamondensis* CuA forks about 1/5–1/6 from apex of clavus. Nevertheless, this slight variation is not regarded as sufficient justification to create a separate genus. “Hind tibiae unarmed or with very small spines”, is another feature described by Muir (1925b). In the Australian material we observed 2–6 small or medium sized spines. These definitions of size are, however, very subjective and might still fall into Muir’s category of “very small spines”.

The six species treated in this paper are endemic to Australia. Maps of the known distribution of each species are shown in Fig 10. *Andes turrondi* is the only species occurring in the Northern Territory, where it inhabits the northern, tropical regions. The species with the widest distribution is *A. migratorius*. It is widely distributed in Queensland and two specimens are even recorded from NSW. *Andes ikelus* has been found in only one locality in Queensland. The data label on the specimen says, “Australia: Queensland Prov.: National Bridge”. This could be a misspelling of Natural Bridge near Brisbane. The other three species show a fairly restricted distribution in Cape York (North Queensland). *Andes moaensis* has also been recorded on Moa Island, in Torres Strait. Based on the fact that the main distribution of the genus lies in the tropical and subtropical areas it is not surprising that the Australian species exhibit a distribution restricted to areas with an average rainfall of more than 1000 mm per year. The representation of species in Cape York seems to indicate that the genus dispersed into Australia via Cape York from SE Asia through New Guinea. This is supported by morphological evidence which shows close links to the Southeast Asian fauna. The Australian species seem to have originated from two different roots. *Andes ikelus* shares external appearance, in particular the colouration of the wing and head, and the general structure of the male genitalia with *Andes distinctus* from Borneo (Sandakan). Based on the presence and shape of the cucullus, other Australian *Andes* should be related with species such as *A. hemina* Fennah (1978) from Malaysia (Kuala Lumpur, Kedah) and Vietnam (Cuq-phuong province), *A. brunneus* Muir (1925) from Borneo (Sandakan) and *A. indistinctus* Muir (1925) from Borneo (Mowong).

The African fauna, with differently shaped male genitalia, lacking virga and cucullus, seems to be distinctly different and may even need to be transferred to a different genus within Andini, which suggests that *Andes* in its current concept represents a paraphyletic taxon. Further taxonomic research, particularly phylogenetic analyses of the world *Andes* fauna, is needed to test our hypotheses of the origins of the Australian *Andes* fauna and the paraphyly of the genus.
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References


FIGURE 4. *Andes dossenus*: A–C aedeagus, (A) left lateral (B) right lateral (C) ventral; D, E anal tube; F, G genital styles.
Abbreviations: cu = cucullus, fl = flagellum, ph = phallotheca, vi = virga.

FIGURE 5. *A. ikelus*: A, B aedeagus, (A) left lateral (B) right lateral; C, D anal tube (damaged); E pygofer, F genital style.

FIGURE 6. *A. lamondensis*: A aedeagus, left lateral; B, C anal tube; D, E genital styles.
FIGURE 7. *Andes migratorius*: A–C aedeagus, (A) left lateral (B) right lateral (C) ventral; D, E anal tube; F, G genital styles.

FIGURE 8. *A. moaensis*: A aedeagus, left lateral; B, C anal tube; D, E genital styles.

FIGURE 9. *A. turrondii*: A, B aedeagus, (A) left lateral (B) dorsal; C, D anal tube; E, F genital styles.