

Supplementary File 2: Document 1. Explanation of characters and their character states. See Supplementary File 3 for figures of characters and their states.

Male genitalia

1. Uncus

- 0: Uncus deeply bifurcated
- 1: Uncus somewhat rounded, with pair of small teeth/spines
- 2: Uncus triangular basally, apically pointed/rounded, notably narrowed for more than third of length distally (may be curved viewed laterally)
- 3: Uncus triangular basally, apically pointed/rounded, without apical narrowing
- 4: Uncus bell-shaped basally with elongated fingerlike distal process (viewed ventrally)
- 5: Uncus thin, spine-like
- 6: Uncus truncated, rectangular
- 7: Uncus truncated but basally triangular

2. Tegumen

- 0: Uncus proximal margin clearly differentiated from tegumen
- 1: Uncus proximal margin continuous with tegumen

3. Gnathos presence

- 0: Gnathos absent
- 1: Gnathos present

4. Gnathos fusion

- 0: Gnathos unfused mesally
- 1: Gnathos fused mesally

5. Gnathos configuration (projections/ arms)

- 0: Gnathos lacking mesal projection(s)
- 1: Gnathos with singular central protuberance/projection, not flattened
- 2: Gnathos with paired projections, narrow, fingerlike (same thickness along length for entire projection)
- 3: Gnathos thin, plate-like
- 4: Gnathos extensions elongate, arm-like, often extending to saccular valva margin
- 5: Gnathos extensions flattened, triangular, not arm-like
- 6: Gnathos extensions robust, boxing glove-like in shape
- 7: Gnathos extensions pair of bifurcated projections (two separate bifurcating structures, four points total)
- 8: Gnathos extensions broadly triangular, heavily sclerotized (not flattened)
- 9: Gnathos extensions pair of thick protuberances held close together mesally
- A: Gnathos synscleritous or attached with membrane to juxta, extensions/projections variable
- B: Gnathos extensions thin, flattened distally, usually with sclerotization weaker distally
- C: Gnathos extensions robust, arm-like, with significant membranous component
- D: Gnathos thin, plate-like with thicker, more heavily sclerotized mesal projection

6. Gnathos base

- 0: Base of gnathos shape not easily defined (often due to being covered by mesal area of a fused gnathos or obscured by huge projections, or simply due to lack of fusion)
- 1: Base of gnathos circular or ovoid, heavily sclerotized
- 2: Base of gnathos rectangular
- 3: Base of gnathos somewhat irregular due to origination of gnathos dorsally on vinculum below uncus such that gnathos margins loop downward

7. Subuncus projections (in addition to gnathos)

- 0: Subuncus projections absent
- 1: Subuncus projections present

8. Valvae tusks

- 0: Absent
- 1: Elongated, usually more than half length of valvae
- 2: Short, not much longer than half valva length

9. Vinculum tusks

- 0: Absent
- 1: Sharp, one tusk or single pair
- 2: Blunt, one tusk or single pair
- 3: Paired, two separate tusk pairs

10. Transtilla/mesal diaphragmal sclerotized plate

- 0: Absent
- 1: Triangular
- 2: Band-like
- 3: Rectangular, plate-like
- 4: Knob-like

11. Valva apodemes/transtilla modifications

- 0: Valvae apodemes/transtilla absent
- 1: Valvae apodemes/transtilla extensions lobe-like covered in setae
- 2: Valvae apodemes/transtilla extensions internally wrinkled triangles/lobes
- 3: Valvae apodemes/transtilla extensions elongated, filamentous
- 4: Valvae apodemes/transtilla extensions columnar, broad, spanning near entire dorsal-ventral height of vinculum
- 5: Valvae apodemes/transtilla extensions spined (multiple)
- 6: Valvae apodemes/transtilla projections blade-like
- 7: Valva apodeme an upward projected lobe, sometimes covered in setae/spines
- 8: Transtilla/valva apodeme/vinculum complex situated back away from vinculum into body cavity, this complex with very elongated, pair of curved tusk-like arms that extend out through center of vinculum over phallus (may also have secondary lobes from base of valvae)
- 9: Valva apodeme as elongated singular tusk-like spines

A: Valvae apodeme/transtilla projections clubbed

12. Sternite VIII modified by heavily sclerotized structures

0: Sternite VIII unmodified, no sclerotized extensions

1: Sternite VIII modified – usually with bifid projections, arms, or Bilobed section

13. Diaphragm

0: Diaphragm without setae

1: Diaphragmal setae in four discrete sacks

2: Diaphragmal setae not in discrete sacks but present

14. Juxta

0: Juxta forming sharp-tipped, hammerhead like extension well above and beyond mostly membranous phallus

1: Juxta limited to connecting point from base of phallus to vinculum

2: Juxta with dorsal projections protuberances/projections (usually paired), but not overly complex such that phallus cannot be excised

3: Juxta/vinculum/diaphragm components complicated otherwise highly sclerotized surrounding phallus with various lateral and/or dorsal projections from phallus, phallus generally difficult to remove due to various complicated connections with juxta and diaphragm

4: Juxta as broad, ridged protuberance fused to phallus

5: Juxta as hood-like process fused to phallus

6: Juxta as pair of knobs on either side of phallus, connecting phallus to vinculum

7: Juxta fused to narrow sclerotizations from base of valvae which swoop forward to meet laterally on either side of phallus

15. Sacculus

0: Sacculus not distinctly thickened/ or with any modified spines/protuberances

1: Sacculus with erect sharp spine/ small curled projection

2: Sacculus with triangular projection (may be situated mesally)

3: Sacculus with triangular projection in addition to mesal valva projection

4: Sacculus with substantial thickening due to curl (which too may be spined)

5: Sacculus with trumpet shaped extension

6: Sacculus with lump

7: Sacculus with substantial thickening, but not curled, often with small clump of spines

8: Sacculus with blunt fingerlike or knob-like projection at base of valvae

9: Sacculus with small projection near to apex of valvae than base

A: Sacculus curled, but not substantially thickened

B: Sacculus broadened near base of valvae/vinculum, densely covered in setae

C: Sacculus more heavily sclerotized and extending beyond ventral edge of valvae

D: Sacculus with indentation

16. Dorsal phallic membrane

0: Absent

1: Present

17. Valvae shape

- 0: Distinctly bent (elbowed)
- 1: Valvae triangular or distally narrowed and lobe-like
- 2: Valvae rectangular, or parallelogram shaped
- 3: Valvae elongated, narrow, paddle-like, narrower than long
- 4: Valvae rounded, wider than long/ width roughly equal to length
- 5: Valvae irregular, mostly sclerotized
- 6: Valvae irregular, mostly membranous
- 7: Valvae upwardly curved/angled/perpendicular to vinculum, usually extending from upper half of vinculum such that base of valvae does not span from base of tegumen to base of vinculum

18. Phallus orientation asymmetrical

- 0: Phallus oriented symmetrically (extending from center of genitalia, outward)
- 1: Phallus oriented asymmetrically (extending from left side of genitalia, outward when viewed ventrally)

19. Vinculum apodemes

- 0: Absent
- 1: Present

20. Phallus shape

- 0: Phallus snake-like
- 1: Phallus sharp, sword-like
- 2: Phallus generally cylindrical/simple overall (terminus variously shaped)
- 3: Phallus distally flattened; distally with sclerotization restricted to margin such that terminal half of phallus appearing “open” from dorsal or ventral perspective, and spade-like in shape due to outline of sclerotized margin or not
- 4: Phallus tubular, very narrow
- 5: Phallus wide (somewhat flattened) curved

21. Vesica

- 0: Vesica simple
- 1: Vesica scobinate (many minute sclerotizations)
- 2: Vesica covered in thick setae

22. Cornutus/cornuti

- 0: Absent
- 1: Present

23. Coecum phallus

- 0: Coecum phallus absent
- 1: Coecum phallus present, simple
- 2: Coecum phallus present, bifurcated

24. Phallus projections (generally more heavily sclerotized than remainder of genitalia)

- 0: Absent
- 1: Phallus with apical ventral (downward) projection
- 2: Phallus with pair of elongated spine-like processes emanating somewhat laterally
- 3: Dorsal protuberance/spine/crest
- 4: Lateral spines
- 5: Distal tip scoop-like
- 6: Distal tip with spine

25. Saccus

- 0: Absent
- 1: Present as solid anteriorad facing lobe (typical saccus)
- 2: Present as upward angled bridge-like sclerotization spanning base of vinculum, often with extended thinly sclerotized sheet-like lip

Female genitalia

26. Apophyses anteriores

- 0: Absent
- 1: Present

27. Apophyses posteriores

- 0: Absent
- 1: Present

28. Apophyses posteriores length

- 0: > apophyses anteriores
- 1: < apophyses anteriores
- 2: = apophyses anteriores

29. Lamella antevaginalis

- 0: Mesally fused by sclerotization
- 1: Mesally unfused/ membranous

30. Ductus and corpus bursae

- 0: Tiny (smaller than papillae anales), baglike/balloon-like
- 1: Elongated for entire length, mostly continuous in width with ductus bursae
- 2: Broad/large (no clear ductus bursae)
- 3: Narrow ductus bursae with balloon-like corpus bursae
- 4: Ductus bursae broader than corpus bursae
- 5: Corpus bursae broad with sclerotized ductus bursae

31. Presence of setae on tergite VIII

- 0: Setae absent
- 1: Setae coverage entire or patchy, but not clumped to either side of ostium bursae
- 2: Setae clumped in nodes on either side of ostium bursae

External morphology

32. Female antennae

- 0: Female antennae dentate/filiform
- 1: Antennae rami continuously shortened
- 2: Antennae rami abruptly shorted

33. Male antennae

- 0: Antennae filiform
- 1: Male pectination continuously shortened along length
- 2: Male pectination abruptly shortened distally

34. Frenulum (coded for male only)

- 0: Absent/reduced to multiple small bristles (i.e. no retinaculum or not generally visible without removing wings)
- 1: Present/obvious as single bristle, usually with retinaculum

35. FW dorsal postmedial line

- 0: Absent
- 1: Poorly defined
- 2: Preapical, band-like
- 3: Preapical, fine to slightly wavy, angled or notably curved toward, and reaching costa apically (not including any continuation toward apex after angle toward costa)
- 4: Preapical, fine, not angled toward, and reaching costa apically
- 5: Fine, fully apical (not angled toward costa)
- 6: Serrate/ crenulate (preapical)

36. FW dorsal antemedial line (any wing)

- 0: Absent
- 1: Present (often very faint)

37. HW dorsal postmedial line

- 0: Absent
- 1: Present

38. HW dorsal antemedial line

- 0: Absent
- 1: Present (often very faint)

39. FW ventral postmedial line

- 0: Absent or nearly so (consisting of several discontinuous spots)
- 1: Continuous, not dentate (straight/ slightly wavy/ smoothly convex)
- 2: Dentate
- 3: Outwardly lobed (not spiked) mesally (often only apical portion apparent)
- 4: Mesally incomplete/ broken by spikes at intersection with veins M3 and CuA1

40. HW ventral postmedial line

- 0: Absent or nearly so
- 1: Not dentate (straight/ slightly wavy/ smoothly convex)
- 2: Dentate
- 3: Outwardly lobed (not spiked) mesally (often only apical portion apparent)
- 4: Mesally incomplete/ broken by spikes at intersection with veins mesally

41. Ventral antemedial line (any wing)

- 0: Absent
- 1: Present

42. FW hyaline patches

- 0: Absent
- 1: Present as B, BB-shape, or oval bisected by M2
- 2: Crescent shaped
- 3: Present in some other configuration

43. HW hyaline patches

- 0: Absent
- 1: Present as B-shape bisected by M2
- 2: Crescent shaped
- 3: Present in some other configuration

44. Costal mark

- 0: Absent
- 1: Present

45. FW dorsal discal mark

- 0: Absent
- 1: Present

46. HW dorsal discal mark

- 0: Absent
- 1: Present

47. FW ventral discal mark

- 0: Absent
- 1: Present

48. HW ventral discal mark

- 0: Absent
- 1: Present

49. Wing margin

- 0: Smooth (sometimes with mesal outward point)

- 1: Crenulate (usually with points at each vein intersection with margin)
- 2: Smooth with tornal notch (FW and HW)

50. Wing apex

- 0: Concave (even if slight) below apex/ deeply falcate
- 1: Not concave below apex, convex or flat

51. Postmedial lunule/tornal line

- 0: Absent
- 1: Well-defined lunule (white/gray)
- 2: Diffuse (brown, black, dark gray)
- 3: Tornal line

52. Apical streak

- 0: Absent
- 1: Present

53. Ventral abdominal line

- 0: Absent
- 1: Present

54. Paired distal abdominal tufts (male only)

- 0: Absent
- 1: Present

55. FW Ventrum apical patch

- 0: Absent
- 1: Present, brown/black heavy contrast against otherwise mostly plain ventrum, often outlined by lunule
- 2: Present, orange to blood red