**INSTITUTO DE BIOCIÊNCIAS**
**PROGRAMA DE PÓS-GRADUAÇÃO EM BIOLOGIA ANIMAL**

**MARCELO REGINATO PAIM**

# PROPOSIÇÃO DO GRUPO ICTERICUS EM *EUSCHISTUS (EUSCHISTUS)*: REVISÃO DE ESPÉCIES NEÁRTICAS, COM DUAS SINONÍMIAS.

**PORTO ALEGRE**

**2020**

**MARCELO REGINATO PAIM**

# PROPOSIÇÃO DO GRUPO ICTERICUS EM *EUSCHISTUS (EUSCHISTUS)*: REVISÃO DE ESPÉCIES NEÁRTICAS, COM DUAS SINONÍMIAS.

Dissertação apresentada ao Programa de Pós-Graduação em Biologia Animal, Instituto de Biociências da Universidade Federal do Rio Grande do Sul, como requisito parcial à obtenção do título de Mestre em Biologia Animal.

Área de concentração: Biologia Comparada

Orientador: Prof. Dr. Filipe Michels Bianchi

Coorientadora: Profª. Drª. Jocélia Grazia

**PORTO ALEGRE**
**2020**

UFRGS
UNIVERSIDADE FEDERAL
DO RIO GRANDE DO SUL

PPGBAN
PROGRAMA DE PÓS-GRADUAÇÃO EM BIOLOGIA ANIMAL

**MARCELO REGINATO PAIM**

**PROPOSIÇÃO DO GRUPO ICTERICUS EM *EUSCHISTUS (EUSCHISTUS)*: REVISÃO DE ESPÉCIES NEÁRTICAS, COM DUAS SINONÍMIAS.**

Aprovada em ____ de _____ de _____.

BANCA EXAMINADORA

_____

Dra. Talita Roell

_____

Dra. Paula Beatriz de Araújo

_____

Dr. Luiz Alexandre Campos

**SUMÁRIO**

**RESUMO**……...6

**ABSTRACT**……...……...8

**INTRODUÇÃO GERAL**……....……..10

**REFERÊNCIAS**……....…….19

**CAPÍTULO I**……....……..27

**ABSTRACT**……....……....27

**INTRODUCTION**……....…….28

**MATERIAL AND METHODS**……....….29

**RESULTS**……....……....30

**FINAL REMARKS**…….…….....47

**REFERENCES**……....……...48

**CONCLUSION**……....……...67

**ANEXO I**……....…….68

## AGRADECIMENTOS

Agradeço a Universidade Federal do Rio Grande do Sul; ao Programa de Pós-Graduação em Biologia animal (PPGBAN-UFRGS) e à coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), por todo o apoio financeiro e logística.

Ao meu orientador Dr. Filipe Michels Bianchi por toda paciência, presença e críticas construtivas nesse trabalho. À minha coorientadora Dra. Jocelia Grazia por ter sido essencial nessa dissertação.

À todos os colegas de laboratório, em especial à Ricardo e Lurdiana por terem me auxiliado inúmeras vezes, esclarecendo dúvidas e sendo grandes amigos. Também, pelas nossas inesquecíveis e construtivas saídas de campo.

Aos meus pais Gerson e Leira por todo o apoio durante essa etapa, e aos meus tios Dirlei e Ana Ruleni.

À Thais Ferreira por toda harmonia e incentivo.

À todos que estiveram presentes durante esse capítulo importante da minha vida, meu muito obrigado.

## RESUMO

Pentatomidae são encontrados em todas as regiões zoogeográficas. É a quarta maior família da subordem Heteroptera, sendo distribuída em dez subfamílias, representadas por aproximadamente 4700 espécies e 800 gêneros, tendo sua maior diversidade nas regiões tropicais e subtropicais. Pentatominae é a subfamília mais diversa entre os pentatomídeos, e sua maior tribo, Carpocorini, reúne diversas espécies prejudiciais à agricultura. *Euschistus* Dallas, 1851 é o maior gênero desta tribo, e sua distribuição é restrita às Américas. Algumas espécies deste gênero possuem importância econômica tanto na América do Norte quanto na do Sul. No Brasil, a principal praga agrícola do gênero é *E. heros* (Fabricius, 1798), enquanto nos Estados Unidos são *E. servus* (Say, 1832)*, E. tristigmus* (Say, 1832) e *E. variolarius* (Palisot de Beauvois, 1817). Com 67 espécies, *Euschistus* é dividido em três subgêneros: o nominal, *Lycipta* e *Euschistomorphus.* O subgênero nominal agrupa 54 espécies e é o maior do gênero. Poucas hipóteses filogenéticas foram propostas para o relacionamento destas espécies. Na ausência de análises filogenéticas em nível específico, alguns agrupamentos utilizando características morfológicas externas, mas principalmente de genitália masculina são tidas como hipóteses válidas de relações entre espécies. A redescrição e revisão taxonômica de espécies é crucial para um melhor entendimento nas proposições das unidades taxonômicas válidas. Descrições simplistas dificultam o reconhecimento preciso das espécies, e trabalhos revisivos são úteis para elucidação taxonômica, isto se torna mais importante no caso de insetos com importância econômica. Um dos agrupamentos sistemáticos dentro de *Euschistus* foi proposto por Stål, e relaciona cinco táxons baseados em similaridades morfológicas e localidade geográfica: *E. ictericus* (Linnaeus, 1763), *E. variolarius* (Palisot de Beauvois, 1817) *E. servus servus* (Say, 1832), *E. servus euschistoide*s (Vollenhoven, 1868), *E. tristigmus tristigmus* (Say, 1832). Adicionalmente, nós incluímos a subespécie válida *E. tristigmus luridus* (Dallas, 1851), *E. inflatus* Van Duzee, 1903, e *E. latimarginatus* Zimmer, 1910. Neste trabalho estas espécies são redescritas, com inclusão de caracteres de genitália feminina interna e externa. No que se refere às subespécies, as variações de populações e regiões de simpatria levou-nos a propor as sinonímias das subespécies *E. servus euschistoides* com *E. servus servus* e de *E. tristigmus luridus* com *E. tristigmus tristigmus*. *Euschistus tristigmus* não seguiu o padrão morfológico das demais espécies do grupo, tendo acentuadas distinções em caracteres de pigóforo, parâmeros, phallus, genitália interna feminina. Neste

trabalho é proposto uma descrição formal do grupo ictericus, com cinco espécies, e são fornecidas fotografias e ilustrações das espécies do grupo, bem como novos caracteres de genitália interna feminina, que podem agregar conhecimento em futuros trabalhos filogenéticos.

**Palavras-chave:** morfologia genital, Neotrópico, percevejos fitófagos, percevejo marrom.

## ABSTRACT

Pentatomidae are found in all zoogeographic regions. It is the fourth largest family of the suborder Heteroptera, distributed within ten subfamilies, represented by approximately 4700 species and 800 genera, being more diverse in tropical and subtropical regions. Pentatominae is the most speciose subfamily among the pentatomids, and its largest tribe, Carpocorini groups several species harmful to agriculture. *Euschistus* Dallas, 1851 is the largest genus of this tribe, and is restricted to the Americas. Some species of the genus are important to the economy both in North and South America. In Brazil, the primary agricultural pest of the genus is *E. heros* (Fabricius, 1798), while in the United States, *E. servu*s (Say, 1832), *E. tristigmus* (Say, 1832) and *E. variolarius* (Palisot de Beauvois, 1817). With 67 species, *Euschistus* is divided into three subgenera: the nominal, *Lycipt*a and *Euschistomorphus*. The nominal subgenus groups 54 species and is the largest of the genera. Few phylogenetic hypotheses have been proposed for the relationship of these species. In the absence of phylogenetic analysis at species level, some groupings using external morphological characteristics, mainly male genitalia, are considered valid hypotheses of relationships between species. The redescription and taxonomic revision of species is crucial for a better understanding of the propositions of valid taxonomic units. Simplistic descriptions hinder the precise recognition of species, and revision papers are useful for taxonomic enlightenment. It becomes more important for insects with economic importance. One of the systematic groupings within *Euschistus* was proposed by Stål, and groups five taxa based on morphological similarities and geographical location: *E. ictericus* (Linnaeus, 1763), *E. variolarius* (Palisot de Beauvois, 1817) *E. servus servus* (Say, 1832), *E. servus euschistoides* (Vollenhoven, 1868), *E. tristigmus tristigmus* (Say, 1832). Additionally, we include the valid subspecies *E. tristigmus luridus* (Dallas, 1851), *E. inflatus* Van Duzee, 1903, and *E. latimarginatus* Zimmer, 1910. In this work, these species are redescribed, including the description of internal and external female genitalia. Regarding the subspecies, variations in populations, and regions of sympatry led us to propose the synonymies of the subspecies *E. servus euschistoides* as a junior synonym of *E. servus servus* and *E. tristigmus luridus* of *E. tristigmus tristigmus*. *Euschistus tristigmus* did not follow the morphological pattern of the other species of the group, presenting distinctions in characters of pygophore, parameres, phallus, and female internal genitalia. This work is proposed a formal description of ictericus

group, including five species, and furnishes photographs and illustrations of the species of the group, as well as new characters of female internal genitalia, which can add knowledge in future phylogenetic works.

**Keywords:** genital morphology, neotropic, phytophagous stink bugs, brown stink bugs

## Introdução geral

A ordem Hemiptera é uma das mais diversas entre os insetos, compreendendo 10% de toda a entomofauna (Grazia *et al.,* 2012). São conhecidas cerca de 89 mil espécies, distribuídas em quatro subordens: Sternorrhyncha, Auchenorrhyncha, Heteroptera e Coleorrhyncha (Grazia *et al.,* 2012). Destas, Heteroptera é a mais especiosa, sendo o maior grupo de insetos hemimetábolos, com aproximadamente 40 mil espécies válidas (Panizzi and Grazia, 2015). Esse grupo é dividido em sete infraordens: Enicocephalomorpha, Dipsocoromorpha, Gerromorpha, Nepomorpha, Leptopodomorpha, Cimicomorpha e Pentatomomorpha, vivendo tanto em ambientes terrestres, quanto em aquáticos, incluindo marinhos, representados por *Halobates* Eschscholtz 1822 (Gerridae) (Chang, 1985). Heterópteros possuem hábitos de vida ativos e sedentários, sendo fitófagos, micetófagos, hematófagos e predadores (Weirauch and Schuh, 2011). Podem ser reconhecidos pela presença das peças bucais com estiletes mandibulares concêntricos entorno dos estiletes maxilares (Grazia *et al.,* 2015). Os trabalhos de Cobben (1968, 1978) foram os precursores na definição de propostas filogenéticas para os heterópteros, porém sem o uso de análises cladísticas formais. Seus estudos, no entanto, abriram caminho para o primeiro trabalho filogenético com metodologia cladística, desenvolvido por Schuh (1979). Após isso, outras análises cladísticas foram desenvolvidas, algumas unicamente com dados morfológicos (Mahner, 1993), outras com moleculares (Xie *et al.,* 2008; Li *et al.,* Weirauch and Štys, 2014; Wang *et al*., 2016; Li *et al.,* 2017), ou ambos (Wheeler *et al.,* 1993; Weirauch *et al.,* 2019).

Pentatomomorpha é a segunda maior infraordem de Heteroptera, compreendendo cerca de 14.000 espécies, sendo superada por Cimicomorpha, que abrange aproximadamente 20.000 espécies. (Schuh and Slater, 1995; Weirauch and Schuh, 2011). Os pentatomomorfos dividem-se em seis superfamílias: Aradoidea, Idiostoloidea, Pentatomoidea, Lygaeoidea, Pyrrhocoroidea e Coreoidea (Rider *et al.,* 2018). Alguns trabalhos abordam as relações filogenéticas em grupos dentro dos pentatomomórfos (Henry, 1997; Xie *et al.* 2005; Grazia *et al.* 2008; Gordon *et al.*, 2016; Wu *et al.,* 2018; Forthman *et al*., 2019), outros tratam da infraordem como um todo, e corroboram sua monofilia (Li *et al.* 2005, 2006; Hua *et al.* 2008; Tian *et al.* 2011; Yao *et al*. 2012; Li *et al*., 2016; Liu *et al.,* 2019).

A superfamília Pentatomoidea, possui sua monofilia bem suportada (Grazia *et al.,* 2008). Atualmente reconhece-se 18 famílias e 8.000 espécies para o grupo, sendo duas dessas famílias fósseis (McPherson *et al.,* 2018). As famílias com ocorrência neotropical são: Acanthosomatidae, Canopidae, Cydnidae, Dinidoridae, Megarididae, Pentatomidae, Phloeidae, Scutelleridae, Tessaratomidae e Thyreocoridae (Grazia *et al.,* 2008; Grazia and Schwertner, 2011). Os pentatomóideos são exclusivamente terrestres, sendo registrados em todos os continentes, exceto na Antártida, e sua maior diversidade é observada em regiões tropicais (Rider *et al.,* 2018; Panizzi *et al.,* 2000). De acordo com a análise filogenética de Grazia *et al.* (2008), suas principais sinapomorfias são o escutelo que ultrapassa a metade do comprimento do abdome, tricobótrios pareados que se localizam lateralmente no abdome, abertura da cápsula genital masculina direcionada posteriormente, ovos esféricos, ovóide ou em forma de barril. Com exceção de Asopinae (Pentatomidae) que possuem hábito predador, e Canopidae sendo micetófagos, os pentatomomorfos conhecidos são fitófagos (McHugh, 1994; Grazia *et al.,* 2015a).

Pentatomidae é representada por cerca de 940 gêneros e 4949 espécies, e é a maior família entre os pentatomóideos e a quarta maior entre os heterópteros (Rider *et al.,* 2018). Estão distribuídos em todas as zonas zoogeográficas mas sua maior diversidade se dá nas zonas tropicais e subtropicais (Grazia *et al.,* 2015b). Caracterizam-se pelas antenas, geralmente com cinco segmentos, embora algumas espécies possuam quatro; escutelo largo e usualmente triangular ou subtriangular e asas posteriores completamente membranosas (Grazia *et al.,* 2015a). São representados por 10 subfamílias: Aphylinae, Asopinae, Cyrtocorinae, Discocephalinae, Edessinae, Pentatominae, Phyllocephalinae, Podopinae, Serbaninae e Stirotarsinae (Rider *et al.,* 2018). Destas, Asopinae, Cyrtocorinae, Discocephalinae, Edessinae e Pentatominae são amplamente distribuídos na região neotropical, sendo Edessinae, Cyrtocorinae, Discocephalinae e Stirotarsinae exclusivas dos neotrópico (Grazia *et al.,* 2015b; Rider *et al.,* 2018). Do ponto de vista econômico, a subfamília Asopinae possui um papel inverso aos pentatomídeos fitófagos, que são pragas de diversos sistemas de cultivo, onde várias espécies são consideradas importantes pragas agrícolas (Panizzi *et al.,* 2000). Por possuírem o hábito predador, os asopíneos podem se alimentar de um grande número de insetos, de diferentes ordens, podendo, neste caso, serem usados como controladores biológicos (Pires *et al.,* 2015). Embora alguns estudos

filogenéticos já tenham sido desenvolvidos em Pentatomidae (Gapud, 1991; Grazia *et al*., 2008; Wu *et al.,* 2016), ainda não existe um trabalho que trate especificamente da monofilia da família.

Tendo distribuição mundial, Pentatominae compreende 660 gêneros e 3484 espécies (Rider *et al.,* 2018). Cerca de ¼ da diversidade dessa subfamília ocorre na região neotropical (Grazia *et al.,* 2015b). Pentatominae reúne mais de 40 tribos, sendo Carpocorini a maior delas. Essa tribo é composta por 127 gêneros e aproximadamente 503 espécies (Rider *et al.,* 2018)

Popularmente conhecidos como percevejos castanhos, *Euschistus* Dallas, 1851 é o maior gênero de Carpocorini, possui distribuição no continente americano e abriga 67 espécies, distribuídas em três subgêneros: *Euschistus (Euschistus)* com 54 espécies*, E. (Lycipta)* Stål, 1862 com 12 espécies e o monotípico *E. (Euschistomorphus)* Jensen-Haarup, 1922 (Rolston, 1984; Bianchi *et al.,* 2017; Weiler *et al.,* 2016). O gênero apresenta as seguintes características gerais: metasterno não pronunciado, peritrema atingindo menos de 2/5 da distância entre o ostíolo e a margem lateral do segmento torácico, fêmures não armados, largura da base do escutelo maior que o dobro da largura do escutelo na intersecção com o ápice da veia frenal, olhos contíguos com o pronoto, superfície da tíbia sulcada, placas mandibulares ou clípeo, ou ambos arredondados apicalmente e usualmente igual em comprimento, búcula evanescente ou truncada na base da cabeça, e antena com cinco segmentos (Rolston, 1974; Cioato *et al.,* 2015). *Lycipta* se caracteriza pela incisão entre o ápice do clípeo e o ápice das placas mandibulares, bem como as paredes laterais da taça genital com processos bem desenvolvidos, membranosos e inflados. A genitália interna masculina possui *ductus seminis distalis* longo e enovelado, os processos da *phallotheca* dilatados na base, e a genitália feminina apresenta uma expansão do *ductus receptaculi* junto à crista anular anterior da espermateca (Rolston, 1982; Weiler *et al.,* 2016). *Euschistomorphus* é diagnosticado pelo prolongamento das placas mandibulares, as quais se estendem além do clípeo (Jensen-Haarup, 1922). Rolston (1984) diagnosticou *Euschistomorphus* pelas placas mandibulares contíguas (ou quase contíguas), diante do clípeo por uma distância subigual ou maior que o diâmetro do olho. Estudos recentes vem tratando dos aspectos filogenéticos dentro do gênero, tanto a nível de subgênero, quanto a nível

genérico (Weiler *et al.,* 2016; Bianchi *et al.,* 2017a). Weiler *et al*. (2016) testaram a monofilia do subgênero *Lycipta,* bem como propuseram hipóteses de relações filogenéticas entre as espécies do grupo, transferindo *Euschistus monrosi* Pirán, 1963 para o subgênero nominal. Bianchi *et al*. (2017a), combinando dados morfológicos e moleculares, recuperaram *Mitripus* como uma linhagem independente de *Euschistus* elevando *Mitripus* a *rank* de gênero, com três espécies - *M. acutus* (Dallas, 1851)*, M. convergens* (Herrich-Schäffer, 1842) e *M. legionarius* (Breddin, 1914). Também propuseram o gênero *Adustonotus* Bianchi, 2017 para incluir as demais oito espécies, anteriormente classificadas em *Mitripus* - *A. tauricornis*, (Stål, 1872) *A. grandis* (Rolston, 1978), *A. hansi* (Grazia, 1987)*, A. paranticus* (Grazia, 1987)*, A. anticus* (Stål, 1860)*, A. latus* (Dallas, 1852)*, A. irroratus* (Bunde, Grazia and Mendonça Junior, 2006) e *A. saramagoi* (Bianchi, Cioato and Grazia, 2015). *Mitripus* e *Adustonotus* foram recuperados como linhagens relacionadas à *Ladeaschistus* Rolston, 1973 e *Sibaria* Stål, 1872. Entre os três subgêneros de *Euschistus*, o nominal é o que contém menos hipóteses filogenéticas formais. Além disto, é considerado um *dumping ground* taxonômico, não havendo caracteres bem estabelecidos para sua diagnose (Cioato *et al.,* 2015).

*Euschistus (Euschistus)* abriga diversas espécies com importância econômica em todo o continente americano (Panizzi *et al.,* 2000). No Brasil, *E.(E.) heros* (Fabricius, 1794) possui ampla distribuição, ocorrendo em praticamente todos os biomas do país. Com o avanço das lavouras de soja, essa espécie vem expandindo sua distribuição pela América do Sul (Soares *et al.,* 2018). Para a América do Norte, *E. (E.) servus* (Say, 1832)*, E. (E.) tristigmus* (Say, 1832)*,* e *E. variolarius* (Palisot de Beauvois, 1817) causam milhões de dólares em prejuízos agronômicos, sendo que os principais cultivos afetados são o tomate (Griffin, 2019) e o algodão (Brown, 2017).

As primeiras hipóteses de agrupamentos em *Euschistus* remetem a Stål (1872). O autor fornece características baseando-se em morfologia externa para agrupamentos hierárquicos dentro do gênero. Primeiramente características abrangendo todos os integrantes do gênero (*i. e.* margem anterolateral do pronoto crenulada ou denticulada, frequentemente sinuosa). Num passo seguinte Stål agrupa algumas espécies do subgênero nominal: *E. (E.) euschistoides* (Vollenhoven, 1868) (Citado como *E. (E.) fissilis* Uhler, 1871)), *E. (E.) servus*,

*E. (E.) tristigmus, E. (E.) impictiventris* Stål, 1872 (posteriormente sinonimizado em *E. servus*), *E. (E.) variolarius, E. (E.) ictericus* (Linnaeus, 1763), *E. (E.) rugifer* Stål, 1872 , *E. (E.) bifibulus* (Palisot de Beauvois, 1805), *E. (E.) crenator* (Fabricius, 1794), *E. (E.) trisinuatus* Stål, 1872 (posteriormente sinonimizado em *E. (E.) atrox* (Westwood, 1837), *E. heros* (Fabricius, 1798), *E. (E.) rufimanus* Stål, 1832*, E. (E.) spurculus* Stål, 1862 e *E. (E.) comptus* Walker, 1868, baseado nas semelhanças, principalmente da morfologia externa (*i. e.* Três antenômeros basais basais pálidos, não pontuados ou obsoletamente pontuados de castanho; membrana cinzenta ou levemente acastanhada). A margem inferior ventral do abdômen nem calosa nem nitidamente pálida, segmentos do conexivo com mancha pálida mediana, atingindo a margem externa, marcada ou externamente pálida. Pronoto posteriormente mal ou levemente convexo, ápices dos segmentos do conexivo com pequeno ponto castanho distinto, são características que excluem *E. comptus* das espécies anteriomente citadas.

Por fim, Stål caracteriza como *Euschistus* verdadeiros (EUSCHISTI propii.) as espécies neárticas que compartilham as seguintes características: membrana geralmente manchada de castanho; dorso abdominal negro, em exemplares imaturos amarelo; Margem posterior do pigóforo côncava. Além destas características morfológicas, o autor baseia-se em localidade geográfica (América do Norte) para reunir as seguintes espécies: *E. (E.) euschistoides*, *E. (E.) servus*, *E. (E.) tristigmus*, *E. (E.) variolarius* e *E. (E.) ictericus*. Desta maneira, Stål expõe seu entendimento sobre relação de proximidade entre estas espécies, por compartilharem características morfológicas e distribuição geográfica. Além disto, é claro sobre sua inferência de relacionamento ao atribuir o nome EUSCHISTI propii. para este agrupamento.

Rolston (1974) em seu trabalho de revisão de espécies do subgênero nominal que ocorrem na América Central, fornece uma chave dicotômica para gêneros comumente confundidos com *Euschistus* (*e. g. Sibaria, Agroecus* Dallas*,* 1851*, Tibraca* Stål, 1860, *Padaeus* Stål, 1862, *Menecles* Stål, 1867, *Hymenarcys* Amyot and Serville, 1843*, Berecynthus* Stål, 1862, *Proxys* Stål, 1862, *Galedanta,* Amyot and Serville, 1843, *Dichelops* Spinola, 1837, baseando-se em características morfológicas gerais, (*e.g.* tamanho e formato do corpo) criando o grupo *Euschistus*. Ainda nesse trabalho, o autor propõe agrupamentos de

espécies por afinidade morfológica. São propostos os grupos crenator, strennus e sulcacitus, baseados em características de morfologia geral e principalmente genitália masculina. O grupo *crenator* abriga três táxons: *E. crenator crenator, E. (E.) crenator orbiculator* Rolson, 1974 e *E. (E.) quadrator*. O grupo *strennus* abriga três espécies: *E. (E.) egglestoni* Rolston, 1974, *E. (E.) leonensis* Rolston, 1974 e *E. (E.) strenuus* Stål, 1862. O grupo *sulcacitus* compreende atualmente cinco espécies: *E. (E.) corcovacitus* Rolston, 1971, *E. (E.) olacitus* Rolston 1971, *E. (E.) palacitus* Rolston, 1971, *E. (E.) sulcacitus* Rolston, 1971 e *E. (E.) tacitus* Bianchi & Grazia, 2017.

Bianchi *et al.,* (2017b), revisaram o grupo *sulcacitus* descrevendo, pela primeira vez, a genitália feminina das espécies do grupo. Historicamente a genitália feminina de Pentatomidae foi negligenciada nas descrições de taxa (Rolston, 1984), no entanto podem apresentar variações entre as espécies, sendo úteis para taxonomia. No grupo *sulcacitus,* Bianchi *et al*., (2017b) apontam variações nas projeções das margens basais dos laterotergitos VIII sobre os gonocoxitos IX, formato da margem mediana dos gonocoxitos IX, região mediana das gonapófises IX, espessamentos secundários das gonapófises IX, e forma das "rings sclerites".

Posteriormente ao agrupamento (EUSCHISTI proprii), outras espécies morfologicamente semelhantes e com distribuição neártica foram descritas: *E. (E.) inflatus* Van Duzee, 1903, e *E. (E.) latimarginatus* Zimmer, 1910. *Euschistus (E.) luridus* Dallas, 1851 vem a ser considerada uma subespécie de *E. (E.) tristigmus* (Van Duzee, 1904), e também compartilha as mesmas características das demais espécies desse agrupamento. Desse modo, esses taxa podem ser incluídos no agrupamento de Stål.

*O histórico das subespécies do agrupamento de Stål.*

É bastante informal o modo como *E. servus* e *E. tristigmus* passaram a conter subespécies. Van Duzee (1904) considera *E. luridus* um sinônimo estrito de *E. tristigmus* e *E. pyrrhocerus* uma variedade, não havendo detalhamentos morfológicos. Posteriormente Esselbaugh e Sailer, ao trocar correspondências, questionam a validade de *E. t. pyrrhocerus*, e mantêm *E. t. luridus* como subespécie válida.

> "Ele me informou que também chegara à conclusão de que *pyrrhocerus* não tinha status de subespécie... Como comentário adicional, ele afirmou que essas evidências tendem a indicar que essa forma não passa de uma resposta a fatores ambientais. Seria interessante ver se essa variante poderia ou não ser derivada da forma *luridus*, que Sailer me disse que considera uma subespécie válida" (Esselbaugh, 1949, p. 162-163).

*E. tristigmus pyrrhocerus* (Herrich-Schaeffer, 1841), ocorre ao sul da latitude 38º (McPherson, 1982) e foi, por muito tempo, considerado uma variedade, forma ou raça por distintos autores (Malloch and Hart, 1919; Blatchley, 1926; Torre-Bueno, 1939; Esselbaugh, 1949; Hoffman, 1971). McPherson (1947), evidenciou que *E. t. tristigmus* é sazonalmente dimórfico e bivoltino, sendo para o verão a forma *pyrrhocerus,* e para outono/primavera, a forma *tristigmus*. Essas diferentes formas resultam das diferenças do fotoperíodo, portanto *E. t. pyrrhocerus* é considerado um sinônimo júnior de *E. tristigmus tristigmus* (McPherson, 1974). *E. t. luridus* ocorre nos Estados Unidos da América e Canadá ao norte da latitude 41º (McPherson, 1982). As subespécies são facilmente diferenciadas pela presença de manchas abdominais e os ângulos umerais mais arredondados (Rider, 2012; Paiero, 2013). *E. t. tristigmus* ocorre no sul sobre a latitude 41º, e seus ângulos umerais são espinhosos, com ausência de manchas abdominais. No trabalho de Rolston (1974) alguns caracteres normalmente utilizados para diferenciar as subespécies de *E. servus* e *E. tristigmus*, são tratados como variações intraespecíficas, (*e.g.*, variações nos ângulos umerais, diferenciações na margem posterior do pigóforo.

O histórico taxonômico de *E. servus* é menos conturbado do que o de *E. tristigmus*, no entanto, também não há muitos detalhamentos morfológicos no que diz respeito a proposição das subespécies, limitado a um pequeno parágrafo de um estudo cujo foco não era taxonômico (Woodside, 1946). Neste trabalho, Sailer sugere que *E. euschistoides* (Vollenhoven, 1868) seja uma população híbrida de *E. servus.* As duas subespécies de *E. servus* ocorrem, em grande parte, na região norte do continente americano (Figura 1), a nominal tem sua distribuição na região sudeste dos Estados Unidos da América e *E. s. euschistoides* ocorre no norte dos EUA em parte do Canadá (McPherson, 1982). Essas subespécies podem ser separadas por caracteres de cabeça, abdome, e coloração de antena.

Através de um longo "cinturão" entre Maryland e Kansas, é registrada a zona de simpatria entre as subespécies (Sailer, 1954), com registos de populações simpátricas também nos estados da Virgínia e Illinois (Woodside, 1946; Hoffman, 1971; McPherson, 1982). McPherson (1982) examinou espécimes do estado de Illinois ao sul da linha que passa ao longo da fronteira norte do condado de Hancock e através do terço inferior de Iroquois (latitude 40º 30'). Ao norte dessa linha, mais de 95% dos espécimes examinados eram *E. s. euschistoides*. Ao sul da linha, foram encontrados tanto *E. s. euschistoides* quanto *E. s. servus*, e indivíduos mostrando a combinação de caracteres de ambas as subespécies, essa porção sul do estado se enquadra dentro do "cinturão" de ocorrência de zona integrativa, corroborando com a observação de Sailer (1954).

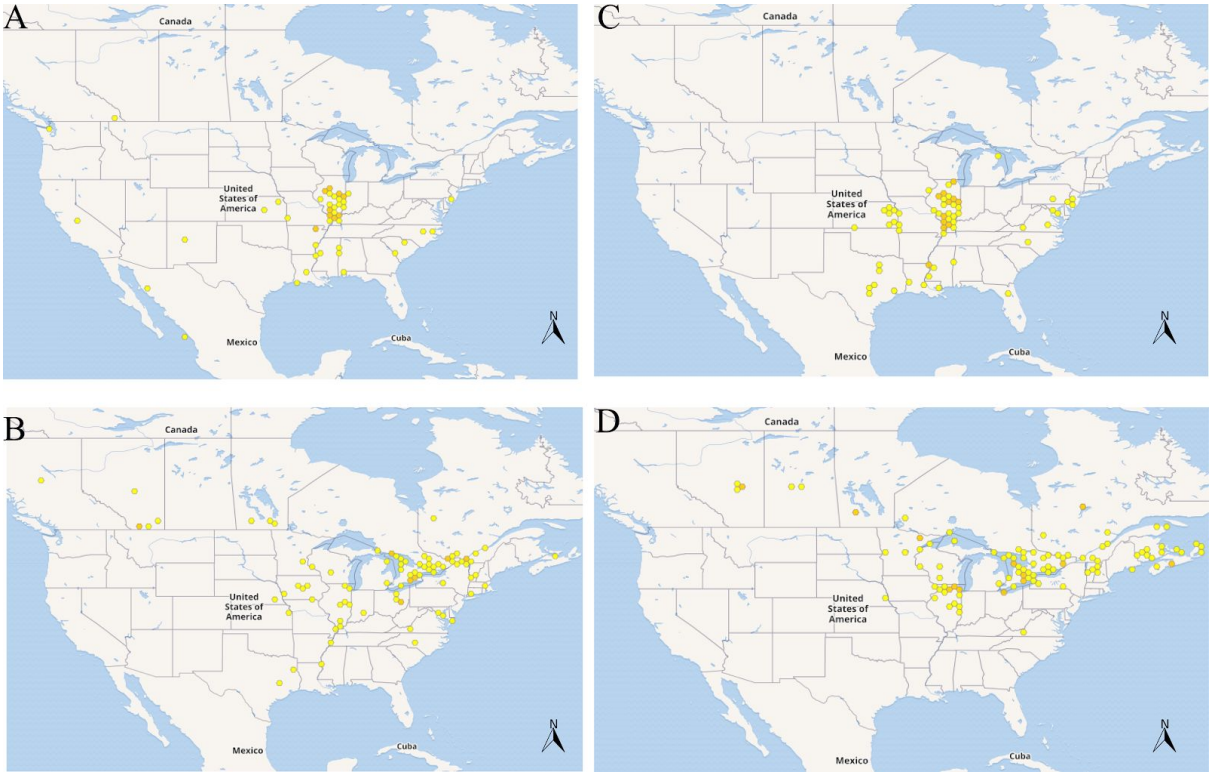



Figura 1. Mapa da distribuição das subespécies: A- *Euschistus (E.) servus servus*- B- *Euschistus (E.) servus euschistoides.* C- *Euschistus (E.) tristigmus tristigmus* D- *Euschistus (E.) tristigmus luridus*. Fonte: www.gbif.org

Poucos trabalhos questionam e exploram a validade destas subespécies (McPherson and Ahmad, 2012). McPherson and Ahmad (2012) observaram as características de genitália masculina interna e externa, e julgaram que não há variações que suportem a divisão das espécies em subespécies, tanto para as subespécies de *E. servus* quanto de *E. tristigmus*. Os

exemplares analisados abrangeram diferentes localidades geográficas. No entanto, nenhuma decisão taxonômica foi tomada, e a validade das subespécies foi mantida.

*Expansão de áreas pela monocultura e áreas simpátricas.*

A rápida conversão de ambientes naturais em áreas agrícolas é algo bastante alarmante, e as consequências para a conservação e manejo de pragas ainda não são amplamente compreendidas (Soares *et al.,* 2018). Espécies nativas consideradas pragas secundárias, ao se estabelecerem em monoculturas, pelo fato da expansão destas áreas agrícolas e diminuição de sua área natural, correm o risco de se tornarem pragas potenciais e verdadeiramente danosas aos sistemas de cultivo (McPherson *et al.,* 2018). A correta identificação taxonômica de espécies que ocorrem em agroecossistemas é um passo fundamental para a implementação de um programa de manejo de insetos (Panizzi *et al.,* 2000). Insetos polífagos como *E. servus,* pragas de culturas agrícolas, locomovem-se entre as plantas hospedeiras. Essa migração é influenciada pelas mudanças fenológicas destas plantas (McPherson and McPherson, 2000; Blinka, 2008). Nos últimos anos, a população de *E. servus* tem aumentado em solo norte americano (Olson *et al.,* 2012; Olson *et al.,* 2018).

Além da literatura primária, repositórios de informação on-line vem auxiliando no monitoramento da distribuição das espécies, bem como suas populações. Genbank (www.ncbi.nkm.nih.gov/genbank), Gbif (www.gbif.org) iNaturalist (www.inaturalist.org) são exemplos de iniciativas independentes umas das outras que recebem de usuários cadastrados informações de ocorrência, dados moleculares e imagens de espécimes. Ao contrário destes, o BOLD (www.boldsystem.org) é a iniciativa que se propõe a dar assistência de curadoria aos dados depositados (Ratnasingham & Hebert, 2007). No entanto, mesmo nos repositórios onde os dados são supostamente depositados por especialistas em táxon, há um número expressivo de identificações não acuradas e errôneas (Meiklejohn *et al.*, 2019). Para *Euschistus*, nota-se uma discrepância entre a literatura e os dados disponíveis on-line. Um exemplo disto é a ausência de referências na literatura para *E. s. servus* no Canadá, os registros existentes são apenas para a subespécie *E. s. euschistoides* com ocorrência no sul do país (Blatchley, 1926; Froeschner, 1988). Desta maneira os mapas de ocorrência on-line trazem informações conflitantes com a literatura do grupo (Figura 1). Também, não são raros os bancos de dados

que trazem identificações facilmente diagnosticáveis como errôneas (*e.g.* http://www.boldsystems.org/index.php/Public_RecordView?processid=CNCHA908-11).

Um facilitador na má compreensão da taxonomia propriamente dita, são as descrições breves e simplistas. A espécie mais antiga dentro de (EUSCHISTI proprii) é *E. ictericus,* descrita no século XVII, possuindo poucos detalhes morfológicos e sendo descrita em poucas palavras (Linnaeus, 1763). As demais espécies desse agrupamento também apresentam descrições antigas e pouco detalhadas. Sendo assim, há uma intrínseca dificuldade no diagnóstico entre as espécies de um grupo que morfologicamente se assemelham e variam intraespecificamente.

*Justificativas e objetivos.*

Uma das principais espécies praga do gênero *Euschistus* nos Estados Unidos da América são *E. servus, E. tristigmus, E. variolarius,* duas dessas espécies possuem muitas imprecisões em seus históricos taxonômicos, o que pode levar a um grande desacordo histórico na literatura científica, (*e. g. E. t. tristigmus, E. t. luridus* e *E. t. pyrrhocerus* tratados como raça, variedade e espécies distintas por diferentes autores, não havendo um consenso entre eles). Além de um estudo revisivo, que enriqueça os dados taxonômicos dos integrantes deste grupo, com descrições morfológicas minuciosas, trabalhos de atualização de descrições perante novas ferramentas tecnológicas são extremamente necessários para que haja um maior entendimento sobre esses carpocorínios. O conhecimento que vem se acumulando com o passar dos séculos, sobre delimitações e descrições de espécies, bem como novas técnicas e ferramentas, nos oportuniza a dar maior robustez nas descrições atuais (De Queiroz, 2007).

O objetivo dessa dissertação foi redescrever e ilustrar as espécies dentro do agrupamento (EUSCHISTI proprii) de Stål, com inclusão de descrição de genitália feminina interna e externa, uma vez que essas estruturas têm sido historicamente negligenciadas para o gênero. O status taxonômico das subespécies foi reavaliado.

**Referências**

Bianchi, F.M., Deprá, M., Ferrari, A., Grazia. J., Valente, V.L.S., and Campos., L.A. 2017a. Total evidence phylogenetic analysis and reclassification of *Euschistus* Dallas within Carpocorini (Hemiptera; Pentatomidae: Pentatominae). Systematic Entomology, **42:** 399–409

Bianchi, F.M., Barão, K.R., and Grazia, J. 2017b. Review of the sulcacitus group of *Euschistus* (Pentatomidae: Pentatominae: Carpocorini) with description of the internal female genitalia and a new species. Zootaxa, **3:** 348–358.

Blatchley, W.S. 1926. Heteroptera or true bugs of easter North America with special reference to the faunas of Indiana and Florida. The Nature Publish Company, Indianapolis.

Blinka, E.L. 2008. Biological and ecological studies on green stink bug, *Acrosternum hilare*, and brown stink bug, *Euschistus servus* (Hemiptera: Pentatomidae), in eastern North Carolina cropping systems. PhD dissertation. North Carolina State University, Raleigh, North Carolina.

Brown, M.L. 2017. Biology, ecology, and economics of brown stink bug, *Euschistus servus* (Heteroptera: Pentatomidae), in desert cotton agroecosystems. Master thesis, The University of Arizona**,** Tucson, Arizona.

Cheng, I. 1985. Biology of *Halobates* (Heteroptera: Gerridae). Annual Review of Entomology, **30 (1):**111–135.

Cioato, A., Bianchi, F.M., Eger, J., and Grazia, J. 2015. New species of *Euschistus (Euschistus)* from Jamaica, *Euschistus (Mitripus)* and *Ladeaschistus* from southern South America (Hemiptera: Heteroptera: Pentatomidae: Pentatominae). Zootaxa, **4:** 565–574.

Griffin, R.P. 2019. Tomato insect pests [online]. Available from www.hgic.clemson.edu/factsheet/tomato-insect-pests/ [acessado em Dezembro, 2019].

Cobben, R.H. 1968. Evolutionary trends in Heteroptera. Part I. Eggs, architecture of the shell, gross embryology and eclosion. Centre for Agricultural Publishing and Documentation, Wageningen, Netherlands.

Cobben, R.H. 1978. Evolutionary trends in Heteroptera. Part II. Mouthpart-structures and feeding strategies. Mededelingen Landbouwhogeschool Wageningen, **78(5):**1–407.

Esselbaugh, C.O. 1949. A bionomic note on the taxonomic status of the form *pyrrhocerus* of *Euschistus tristigmus* Say. Proceedings of the Entomological Society of Washington, **51:** 160–163.

Forthman, M., Miller, C.W., and Kimball, R.T. 2019. Phylogenomic analysis suggests Coreidae and Alydidae (Hemiptera: Heteroptera) are not monophyletic. Zoologica Scripta, **48:** 520–534.

Froeschner, R.C. and Henry, T.J. 1988. Genus *Euschistus* Dallas, 1851. *In:* Catalog of the Heteroptera, or True Bugs of Canada and the Continental United States. *Edited by* T.J., Henry and R.C. Froeschner. E.J. Brill, Leiden, New York, Kobenhavn, Koln. Pp. 576-580.

Gapud, V.P. 1991. A generic revision of the subfamily Asopinae, with consideration of its phylogenetic position in the family Pentatomidae and superfamily Pentatomoidea (Hemiptera-Heteroptera). The Philippine Entomologist, **8**: 865–961.

Gordon, E.R.L., McFrederick, Q., and Weirauch, C. 2016. Phylogenetic evidence for ancient and persistent environmental symbiont reacquisition in Largidae (Hemiptera: Heteroptera). Applied Environmental Microbiology, **82 (24):** 7123–7133.

Grazia, J., and Schwertner, C.F. 2011. Checklist dos percevejos-do-mato (Hemiptera: Heteroptera: Pentatomoidea) do Estado de São Paulo, Brasil. Biota Neotropica, **11:** 1–12

Grazia J., Cavicchioli, R.R., Wolff, V.R.S., Fernandes, J.A.M., and Takiya, D.A. 2012. Hemiptera. *In* Insetos do Brasil: Diversidade e Taxonomia. *Edited by* J.A. Rafael, G.A.R. Melo, C.J.B.Carvalho, S. Casari, and R. Constantino. Holos Editora, São Paulo. Pp. 347–405.

Grazia, J., Simões, F.L. and Panizzi, A.R. 2015a. Morphology, ontogeny, reproduction and economic importance of stink bugs (Pentatomidae). *In* True Bugs (Heteroptera) of the Neotropics. *Edited by* A.R. Panizzi and J. Grazia. Springer Science, Dordrecht. Pp. 21–55.

Grazia, J., Panizzi, A.R., Greve, C., Schwertner, C.F., Campos, L.A., Garbelotto, T.A., and Fernandes, J.A.M. 2015b. Stink Bugs (Pentatomidae). *In* True Bugs (Heteroptera) of the Neotropics. *Edited by* A.R. Panizzi and J. Grazia. Springer Science, Dordrecht. Pp. 681–756.

Grazia, J., Schuh, R.T., and Wheeler, W.C. 2008 Phylogenetic relationships of family groups in Pentatomoidea based on morphology and DNA sequences (Insecta: Heteroptera). Cladistics, **24:** 932–976.

Hasan, S.A. and Kitching, I.J. 1993. A cladistics analysis of the tribes of the Pentatomidae (Heteroptera). Japanese Journal of Entomology, **61:** 651–669.

Hart, C.A. and Malloch, J.R. 1919. *Euschistus* Dallas. Key to Species. *In* The Pentatomoidea of Illinois with keys to the Nearctic genera. Illinois Natural History Survey Bulletin, **13:**189–191.

Henry, T.J. 1997. Phylogenetic analysis of family groups within the infraorder Pentatomomorpha (Hemiptera: Heteroptera), with emphasis on the Lygaeoidea. Annals of the Entomological Society of America, **90:** 275–301.

Hua, J., Li, M., Dong, P., Cui, Y., Xie, Q., and Wenjun, B. 2008. Comparative and phylogenomic studies on the mitochondrial genomes of Pentatomomorpha (Insecta:

Hemiptera: Heteroptera). BMC Genomics **9:** 610. http://www.biomedcentral.com/1471-2164/9/610

Hoffman, R.L. 1971. The Insects of Virginia: No. 4. Shield bugs (Hemiptera; Scutelleroidea, Corimelaenidae, Cydnidae, Pentatomidae). Virginia Polytechnic Institute and State University, Research Division Bulletin.

Jensen-Haarup, A.C. 1922. Hemipterological notes and description II. Entomologiske Meddelelser, **14:** 1–16.

Li, H.M., Deng, R.Q., Wang, J.W., Chen, Z.Y., Jia, F.L., and Wang, X.Z. 2005. A preliminary phylogeny of the Pentatomomorpha (Hemiptera : Heteroptera) based on nuclear 18S rDNA and mitochondrial DNA sequences. Molecular Phylogenetics and Evolution, **37:** 313-326.

Li, H.M., Deng, R.Q., Wang, X.Z. 2006. Phylogenetic relationship of the Pentatomomorpha (Hemiptera: Heteroptera) inferred from nuclear 18S rDNA sequences. Zoological Research, **27:** 307-316

Li, T., Hua, J., Wright, A.M., Cui, Y., Xie, Q., Bu, W., and Hillis, D.M., 2014. Long-branch attraction and the phylogeny of true water bugs (Hemiptera: Nepomorpha) as estimated from mitochondrial genomes. BMC Evolutionary Biology, **14 (1)**: 99. doi: 10.1186/1471-2148–14-99.

Li, H., Leavengood, J.M., Chapman, E.G., Burkhardt, D., Song, F., Jiang, P., Liu. J., Zhou, X., and Cai, W. 2017. Mitochondrial phylogenomics of Hemiptera reveals adaptive innovations driving the diversification of true bugs. Proceedings of the Royal Society B: Biological Sciences, **284** (1862). doi: 10.1098/rspb.2017.1223.

Li, M., Wang, Y., Xie, Q., Tian, X., Li, T., Zhang, H., and Bu, W. 2016. Reanalysis of the phylogenetic relationships of the Pentatomomorpha (Hemiptera: Heteroptera) based on ribosomal, Hox and mitochondrial genes. Entomotaxonomia **38**: 81–91.

Linnaeus, C.V. 1763. Centuria insectorum rariorum. Amoenitates academicae, **6:** 384–415.

Liu, Y., Li, H., Song, F., Zhao, Y., Wilson, J.-J., and Cai, W. 2019. Higher-level phylogeny and evolutionary history of Pentatomomorpha (Hemiptera: Heteroptera) inferred from mitochondrial genome sequences. Systematic Entomology **44(4)**: 810–819.

Mahner, M. 1993. Systema Cryptoceratorum Phylogeneticum (Insecta, Heteroptera). Zoologica, **48**: 1–302.

McHugh J.V. 1994. On the natural history of Canopidae (Heteroptera: Pentatomoidea). Journal of the New York Entomological Society, **102(1):**112–114.

McPherson, J.E. 1974. Photoperiod effects in a southern Illinois population og the Euschistus tristigmus complex (Hemiptera: Pentatomidae). Annals of the Entomological Society of America, **67:** 943–52.

McPherson, J.E. 1982. The Pentatomoidea (Hemiptera) of northeastern North America with emphasis on the fauna of Illinois. Southern Illinois University Press, Carbondale.

McPherson, J. E., and R. M. McPherson. 2000. Stink bugs of economic importance in America North of Mexico. CRC Press, Boca Raton, Florida.

McPherson, J.E., and Ahmad, I. 2012. Comparison of Male Genitalia of *Euschistus* spp. in the Midwestern United States (Hemiptera: Heteroptera: Pentatomidae). Annals of the Entomological Society of America, **105 (3):** 395–402.

Meiklejohn, K. A., Damaso, N., and Robertson, J. M. 2019. Assessment of BOLD and GenBank – Their accuracy and reliability for the identification of biological materials. PLOS ONE, **14(6):** e0217084.

Olson, D.M., Ruberson, J.R., and Andow, D.A. 2012. Effects on stink bugs of field edges adjacent to woodland. Agriculture, Ecosystems and Environment, **156:** 94–98.

Olson, D.M., Prescott, K.R., Zeilinger, A.R., Hou, S., Coffin, A.W., Smith, C.M., Ruberson, J.R., and Andow, D.A. 2018. Landscape effects on reproduction of *Euschistus servus* (Hemiptera: Pentatomidae), a mobile, polyphagous, multivoltine arthropod herbivore. Environmental Entomology, **47(3):** 660–668.

Paiero, S.M. Marshall, S.A. McPherson, J.E., and M.-S. Ma. 2013. Stink bugs (Pentatomidae) and parent bugs (Acanthosomatidae) of Ontario and adjacent areas: A key to species and a review of the fauna. Canadian Journal of Arthropod Identification, **24:** 1–183.

Panizzi, A.R., McPherson, J.E., James, D.G., Javahery, M., Robert M., and McPherson, R. M. 2000 Stink bugs (Pentatomidae). *In:* Heteroptera of economic importance. *Edited by* C.W. Schaefer. , A.R. Panizzi. CRC Press, Boca Raton. Pp. 421–474

Panizzi, A. R and Grazia, J (2015) Introduction to True Bugs (Heteroptera) of the Neotropics. *In* True Bugs (Heteroptera) of the Neotropics. *Edited by* A.R. Panizz and J. Grazia. Springer Science, Dordrecht. Pp. 3–20.

Pires, E.M., Soares, M.A., Nogueira, R.M., Zanuncio, J.C., Moreira, P.S.A., De Oliveira M. 2015. Seven decades of studies with Asopinae predators in Brazil (1933-2014). Bioscience Journal, **31:** 1530–1549.

Ratnasingham, S., and Hebert, P. D. N. 2007. BOLD: The Barcode of Life Data System [online]. Available from www.barcodinglife.org. Molecular Ecology Notes, **7(3):** 355–364. [accessed 28 January 2020].

Rider, D.A. 2012. The Heteroptera (Hemiptera) of North Dakota I: Pentatomomorpha: Pentatomoidea. The Great Lakes Entomologist, **45:** 312–380.

Rider, D.A., Schwertner, C.F., Vilímová, J., Rédei, D., Kment, P., Thomas, D.B. 2018. Higher Systematics of the Pentatomoidea. *In* Invasive Stink Bugs and Related Species (Pentatomoidea). *Edited by* J.E. McPherson. CRC Press, Boca Raton. Pp. 25–201

Rolston, L.H. 1974. Revision of the genus *Euschistus* in Middle America (Hemiptera, Pentatomidae, Pentatomini). Entomologica Americana. **48:** 1–102.

Rolston, L.H. 1982. A revision of *Euschistus* Dallas subgenus *Lycipta* Stål (Hemiptera: Pentatomidae). Proceedings of the Entomological Society of Washington. **84:** 281–296

Rolston, L.H. 1984. Key to the males of the nominate subgenus *Euschistus* in South America, with descriptions of three new species (Hemiptera: Pentatomidae). New York Entomological Society, **92 (4):** 352–364.

Sailer, R.I., 1954. Interspecific hybridization among hnsects with a report on crossbreeding experiments with stink bugs. Journal of Economic Entomology, **47:** 377–383

Schuh, R.T. 1979. Review of evolutionary trends in Heteroptera. Part II. Mouthpart structures and feeding strategies. By R. H. Cobben. Systematic Zoology, **28:** 653–656.

Schuh, T.R. & Slater, J.A. 1995. True bugs of the world (Hemiptera: Heteroptera): Classification and natural history. Cornell University Press, Ithaca.

Soares, P.L., Cordeiro, E.M.G., Santos, F.N.S., Omoto, C., and Correa, A.S. 2018. The reunion of two lineages of the Neotropical brown stink bug on soybean lands in the heart of Brazil. Scientific Reports, **6**; 8(1): 2496. doi: 10.1038/s41598–018–20187–6.

Stål, C. 1872. Enumeratio Hemipterorum, Enumeratio Cimicinorum Americae. Kongliga Svenska Vetenskaps-Akademiens Handlingar, **10:** 3–65.

Tian, X., Xie, Q., Li, M., Gao, C., Cui, Y., Xi, L., and Bu, W. 2011. Phylogeny of pentatomomorphan bugs (Hemiptera-Heteroptera: Pentatomomorpha) based on six Hox gene fragments. Zootaxa, **2888:** 57–68.

Torre-Bueno, J.R. de la. 1939. A synopsis of the Hemiptera-Heteroptera of America north of Mexico. Part I Families Scutelleridae, Cydnidae, Pentatomidae, Aradidae, Dysodiidae and Termitaphididae. Entomologica Americana, **19:** 141–304.

Wang, Y., Cui, Y., Redei, D., Bana r, P., Xie, Q., Stys, P., Damgaard, J., Chen, P., Yi, W., Wang, Y., Dang, K., Li, C., Bu, W. 2016. Phylogenetic divergences of the true bugs (Insecta:

Hemiptera: Heteroptera), with emphasis on the aquatic lineages: the last piece of the aquatic insect jigsaw originated in the Late Permian/Early Triassic. Cladistics **32:** 390–405.

Weiler, L., Ferrari, A. and Grazia, J. 2016 Phylogeny and biogeography of the South American subgenus *Euschistus* (*Lycipta*) Stål (Heteroptera: Pentatomidae: Carpocorini). Insect Systematics and Evolution, **47:** 313–346.

Weirauch, C. and Schuh, R.T. 2011. Systematics and evolution of Heteroptera: 25 years of progress. Annual review of Entomology, **56:** 487–510.

Weirauch, C. and Štys, P., 2014. Litter bugs exposed: phylogenetic relationships of Dipsocoromorpha (Hemiptera: Heteroptera) based on molecular data. Insect Systematic Evolution, **45**: 351–370.

Weirauch, C., Schuh, R.T., Cassis, G., and Wheeler, W.C. 2019. Revisiting habitat and lifestyle transitions in Heteroptera (Insecta: Hemiptera): insights from a combined morphological and molecular phylogeny. Cladistics, **35 (1)**: 67–105.

Wheeler, W. C., Schuh, R.T. and Bang, R. 1993. Cladistic relationships among higher groups of Heteroptera: congruence between morphological and molecular data sets. Insect Systematics and Evolution, **24**: 121–137.

Woodside, A M. 1946. Life history studies of *Euschistus servus* and *E. tristigmus.* Journal of Economic Entomology, **39:** 16–163.

Wu, Y.Z., Yu, S.S., Wang, Y.H., Wu, H.Y., Li, X.R., Men, X., Zhang, Y.W., Redéi, D., Xie, Q., and Bu, W.J. 2016. The evolutionary position of Lestoniidae revealed by molecular autapomorphies in the secondary structure of rRNA besides phylogenetic reconstruction (Insecta: Hemiptera: Heteroptera). Zoological Journal of the Linnean Society **1774:** 750–763.

Wu, Y.Z., Rédei, D., Eger, J., Wang, Y.H., Wu, H.Y., Carapezza, A., Kment, P., Cai, Bo., Sun, X.Y., Guo, L.P., Luo, J.Y. and Xie, Q. 2018. Phylogeny and the colourful history of jewel bugs (Insecta: Hemiptera: Scutelleridae) Cladistics **5:** 34 1–15

Xie, Q., Bu, W., Zheng, L. 2005. The Bayesian phylogenetic analysis of the 18S rRNA sequences from the main lineages of Trichoptera (Insecta: Heteroptera: Pentatomomorpha). Molecular Phylogenetics and Evolution, **34:** 448–451.

Xie, Q., Tian, Y., Zheng, L., and Bu, W. 2008. 18S rRNA hyper-elongation and the phylogeny of Euhemiptera (Insecta: Hemiptera). Molecular Phylogenetics and Evolution, **47:** 463–471.

Yao, Y., Ren, D., Rider, D.A., and Cai, W. 2012. Phylogeny of the infraorder Pentatomomorpha based on fossil and extant morphology, with description of a new fossil family from China. PLOS One, **7 (5):** e37289. doi: 10.1371/journal.pone.0037289.

## Capítulo I [1]

# Proposition of the ictericus group in *Euschistus (Euschistus)* (Hemiptera: Pentatomidae) Review of Neartic species, with two synonyms.

**Marcelo R. Paim[1], Jocelia Grazia[1], David. A. Rider[2] and Filipe M. Bianchi[1]**

[1]*Laboratório de Entomologia Sistemática, Departamento de Zoologia, Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.*

[2]*Entomology Department, School of Natural Resource Sciences, North Dakota State University, Fargo, ND, USA. Email: david.rider@ndsu.edu*

**Abstract:** *Euschistus* Dallas is distributed in the American continent, and is composed of 67 species into three subgenera. Among them, the nominate subgenera lacks any formal phylogenetic hypothesis. *Euschistus (Euschistus)* includes species of economic importance both South and North America. In the absence of a phylogenetic analysis at species level, systematics groupings using mainly male genitalia were proposed. In this work, the following nearctic species: (*E. ictericus* (Linnaeus), *E. variolarius* (Palisot de Beauvois), *E. servus servus* (Say), *E. servus euschistoides* (Vollenhoven) and *E. tristigmus* (Say)), is revised. Since similar characteristics are shared by other *Euschistus* species of nearctic region, we include in this study *E.tristigmus luridus* (Dallas), *E. inflatus* Van Duzee, and *E. latimarginatus* Zimmer. These species have very brief descriptions and few morphological details. Here, we propose the **ictericus** group and redescribed the species of this group. The morphological variations among intraspecific populations and sympatric areas led us to consider *E. s. euschistoides* a junior synonym of *E. s. servus* and *E. t. luridus* a junior synonym of *E. t. tristigmus.*

Keywords: Brown stink bugs, crop pest, taxonomy, genitalia, morphological features

[1] Formatado conforme as normas do periódico The Canadian Entomologist. Veja Anexo I

**Introduction**

*Euschistus* Dallas (Hemiptera: Pentatomidae), is the largest genus within Carpocorini, currently comprising 67 species, distributed in three subgenera, the nominal, including 54 species, *Lycipta* Stål with 12 species, and the monotypic *Euschistomorphus* Jensen-Haarup (Bianchi *et al*., 2017a). *Euschistus* is restricted to the new world (Rolston, 1984; Cioato *et al.,* 2015), occurring from Canada to Argentina, with a high diversity concentrated in Central America. The brown bugs are phytophagous, and some species are highly polyphagous, causing severe damages in crop plants, mainly leguminous (Panizzi *et al.,* 2000; Smaniotto and Panizzi, 2015). The major harmful species to agriculture are: *E. (Euschistus.) heros* (Fabricius), *Euschistus servus* (Say), and *E. tristigmus* (Say) (Panizzi *et al.,* 2000), the former in the Neotropical region, and the two last in the Nearctic.

Recent studies dealing with *Euschistus* have changed the classification within the genus (Weiler *et al.,* 2016; Bianchi *et al.,* 2017a). The monophyly of *Lycipta* was recovered, and this subgenus was hypothesized as the sister group of *Euschistus* (*Euschistus*) (Weiler *et al.,* 2016). Bianchi *et al*. (2017a) in a phylogenetic study of *Euschistus* raised three out of 11 species from the former subgenus *Mitripus* Rolson to rank genus, as well as proposed the new genus, *Adustonotus* Bianchi, to include the remaider eight species previously placed in *Euschistus* (*Mitripus*). According to the phylogenetic hypothesis of Bianchi *et al*. (2017a), those two genera are more related to *Sibaria* Stål, and *Ladeaschistus* Rolston, than to *Euschistus* and its three remaining subgenera. Thus, *Adustonotus*, *Ladeaschistus*, *Mitripus*, and *Sibaria* composed mostly a South American lineage within Carpocorini.

*Euschistus* is still considered a taxonomic dumping ground (Cioato *et al.,* 2015). Regarding the nominal subgenus, most species occur mainly in Central and North America (Rolston, 1984), although the distribution of the genus is underestimated, once some of them are known only by the type series. The hypothetical relationships among the species within the subgenus *Euschistus* are not based on phylogenetic methods, but empirical groupings based on similarities. Rolston (1974) proposed the species groups strennus, crenator, and sulcacitus, taking into account the general morphology and only external male genitalia. As stated by Rolston (1974) "the genital plates (external female genitalia) are seldom taxonomically helpful, but the spermatheca differs among the few species that were examined", thus the female genitalia are often neglected in descriptions. However, Bianchi *et al.* (2017b) reviewed the sulcacitus group, including descriptions and illustrations of the female genital structures, both internal and external. These structures presented variations among the species and are included in the diagnoses of those species.

Stål (1872) had inferred an empirical grouping to the following taxa of the nominate subgenera: *E. servus servus*, *E. servus euschistoide*s, [cited as *E. fissilis* (Uhler)], *E. tristigmus*, *E. variolarius* (Palisot de Beauvois), and *E. ictericus* (Linnaeus), based on morphology and geographical distribution. Additionally, we include *E. tristigmus luridus* (Dallas), and also *E. inflatus* Van Duzee, and *E. latimarginatus* Zimmer, that were described after Stål (1872) and share characteristics with Stål's empirical group.

One out of the main roles of taxonomy is to describe species, naming and classifying units of biodiversity according to supposed evolutionary history and to ground these hypotheses with data, most frequently phenotypes (Deans *et al.* 2012). Since the concise descriptions made by Linnaeus [e. g. see *Euschistus ictericus* described as *Cimex ictericus* (1763, p.16)] our understandings on species limits and capacity to refine the descriptions have changed (De Queiroz, 2007), and also evidences to support or dismiss the validation of a scientific name. The species descriptions (delimitations) should be updated under the scrutiny of the current methods, homology hypotheses, and terminologies, mainly those described centuries ago. The aim of this work is to review eight taxa of *Euschistus* from nearctic region, including either internal and external genitalia of both sexes.

**Material and methods**

Specimens were observed and measured under a light stereomicroscope. The following 15 morphometric parameters were taken and are presented in millimeters (mean ± standard deviation): total body length (BL), abdominal width (AW), maximum width of head (HW), length of head (HL), length of head before eyes (LE), interocular distance (ID), length of antennomeres: I (I), II (II), III (III), IV (IV), V (V), maximum pronotal width (PW), pronotal length (PL), and maximum scutellar width (SW). scutellar length (SL) (Table 1-2).

The specimens used for this study were borrowed from the following collections:

AMNH American Museum of Natural History, New York, USA
DAR David A. Rider Personal collection
JEE John E. Eger Personal collection
MNRJ Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil
MZUSP Museu de Zoologia da Universidade de São Paulo, São Paulo, Brazil
UFRG Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

Intending to access and describe the internal male and female genitalia, the abdomen in females and pygophore in males were removed. The abdomen of female were kept in potassium hydroxide aqueous solution (10% KOH), heated for 10 minutes. After this process, the structures were washed with distilled water, dehydrated in alcohol 70%, and stained with congo red aqueous solution. The pygophores were kept in KOH at room temperature for 48 hours, for removal of internal structures. Both internal and external genitalia were photographed in sequential focus by means Nikon AZ100M and digitized in the NIS Elements software, available at the Zoology Department of UFRGS. The genitalic terminology followed Baker (1931) and Dupuis (1970), for parameres followed Tsai *et al.* (2011).

For data labels, a slash (/) was used to divide the rows of the same label. The separation of different labels was represented by a double slash (//). Square brackets [] were

used to represent additional information. For the data handwritten, was used the abbreviation Hw inside a square bracket (Kment 2012).

The distribution data was based in the catalog of Froeschner and Henry (1988) and others literatures (McPherson, 1982; Rider, 2012; Packauskas, 2012; Bundy, 2014; Koch *et al*., 2014;).

**Results**

***Euschistus* (*Euschistus*) *ictericus* (Linnaeus, 1763)**

(Figures 1, 9, 17–18, 25–33, 48,56–58, 80, 88, 96–98)

*Cimex ictericus* Linnaeus, 1763:16.

*Euschistus ictericus*: Dallas, 1851:206.

*Euschistus (Euschistus) ictericus*: Stål, 1872:26.

**Material examined:** ♀/ USA/ Louisiana/ Plaquemines/ Par Pt Sulphur/ Citrus Res Stn/ 3-Vii-1988 [hw, 3-VII-] / B. Gregory Jr// D. A. Rider Collection (Abdomen removed)// ♀ USA/Louisiana/ Iberville Par St/ Gabriel Expt. Sta/ 7-IX-1986 [hw, white label] / D. A. Rider (Abdomen removed) // D. A. Rider// ♀ USA/ [Louisiana]/ E. Baton Rouge Parish/ ?-VI-1970 [hw, white label] // L. H. Rolston Collection// (col.. MRCN- 002717)// ♀ USA/ Florida/ Henry Co. Clewiston/ 15-VII-1982 [hw, white label]/ J. E, Coll;// J.E. Eger Collection// ♀ USA/ Florida/ Highlands Co/ Archbold Bo. Station/ 28-V-1995/ Skillman and Kutis/ UV and MV light//det. J. E. Eger 2015// J. E. Eger Collection// ♂ USA/ Louisiana/ Plaquemines Par Pt, Sulphur/ Citrus/ Res Stn/ 10-VI-1988/ B. Gregory, Jr// D.A. Rider Collection (Phygophore removed)// ♂ USA/ Florida/ Hendry Co/ Clewiston/ 15-VIII-1982 [hw, white label]/ J.E. Eger Coll// det, J.E. Eger, 2015// J. E. Eger Collection// ♂ USA/ Florida/ W. Palm Beach Co/ Belle Glade/ 27-VI-1986 [hw, white label]/ J. E. Eger, Coll// det, J. E Eger, 2015// J. E. Eger Collection// ♂ USA/ Louisiana/ Plaquemines/ Par Pt/ Sulphur/ Citrus Res/ St 3-VII- [hw, white label] 1988/ B. Gregory, Jr// D. A Rider Collection// ♂/ Texas/ Burleson Co/ TAMU Res. Farm/ Hwy. 50, 2 mi. S of Hwy. 60/ Aug 18, 2008/ Coll: C. W. Hubbard/ ex. Blacklight trap//.

**Diagnosis:** This species can be diagnosed by the ferrugineous humeral angles often spinose, and a weak transversal unpunctured pale line between humerus (Fig. 1). Median projections of dorsal rim of pygophore flanked by lateral concavities. The median projection of dorsal rim presenting a mesial notch V-shaped (Figs. 27, 56–58).

**Redescription**

**General coloration.** Dorsal surface light brown to brownish ferruginous with dark brown to black punctures. Ventral surface slightly paler than dorsal surface, varying from light brown to brown (Figs. 1–9). **Head:** Antennae reddish brown to light brown. Ocelli reddish brown to brown, surrounded by a thin reddish ring; elliptical area between ocelli and eyes unpunctured. A black band is present in front of the eyes in lateroventral view. **Thorax:** Anterolateral margin of pronotum lighter than the disc. Punctures more scattered at the pronotal disc.

Pronotal disc with a weak transversal unpunctured pale line between humeri. Cicatrices of pronotum concolour with disc, bearing few punctures; humeral angles reddish. Punctures on scutellum becoming more sparse and smaller onto apex, sometimes the apex of scutellum with an unpunctured and light brown area. Punctures more sparse and smaller at endocorium and onto the apex of forewings; membrane of hemelytra hyaline bearing small fumose spots. Ventrally presenting 1+1 black spot at anterior margin of propleurum, close to the eyes and 1+1 black spots on suprecoxal cleft; on mesopleurum 1+1 at supracoxal cleft and another 1+1 laterally; on metapleurum 1+1 at base of evaporatorium. Legs varying from concolour with ventral surface to ferruginous, sometimes presenting small black dots at femur. **Abdomen:** Connexivum light brown, bearing a light brown macula mesially. Spiracle black or pale. Transversal dark or pale band between spiracle and trichobothria. Urosternites IV and V may present a reddish irregular macula medially. Spiracles varying from black to pale (Fig. 18).

**Head:** Clypeus slightly longer than mandibular plates; both rounded or slightly acuminate apically; the mandibular plates rarely present an incision close to clypeus. Anterior margin of bucculae rounded, posterior margin evanescent; the rounded portion with a concave surface. Antennomeres proportion: I<II<III=IV=V. Rostrum slightly surpassing the metacoxae. **Thorax:** Anterolateral margin of pronotum serrated, extending over half of anterolateral margin. Humeral angles acute or produced laterally in spine (Fig. 17). Small foveas present. Evaporatorium surface unpunctuated, spread onto posterior margin of mesopleuron and more than halfway from ostiole to metapleural lateral margin; shallow gyrification close to the ostiole; ostiole guttiform; peritreme spout-like. **Abdomen:** Connexivum well exposed. Base of urosternite III presenting a slight tumescent area medially. Posterolateral angles of urosternite VII projected in spine. **Female genitalia (**Figs. 25–26, 32–33, 48)**: In Posterior view:** Gonocoxites VIII presenting few shallow punctures on the disc, concolour with the disc; mesial margins straight, not overlapped, and elevated apically; posterior margins of gonocoxites VIII concave medially, posterolateral margins rounded and projected posteriorly, surpassing the middle of gonocoxites IX. Gonocoxites IX triangular, posterior and lateral margins rounded, anterior margin arched; wider than long; surface crenulated, with setae; depressed triangular smooth area at the base (Fig. 32). **Posteroventral view:** posterior margin of gonocoxites VIII sinuose, concave medially, rounded posterolaterally, apex of mesial margin acute. Laterotergites VIII diamond-shaped and posteriorly projected as a stout spine; laterotergites IX somewhat triangular; lateral and medial margins straight, lateral margins convergent, mesial margins divergent; apex rounded, with long setae; apex surpassing the tergites VIII; both laterotergites VIII and IX reflexed apically; segment X rectangular, longer than wide (Figs. 25, 33). **Internal genitalia:** Ring sclerites fusiform; thickening of vaginal intima with posterior region triangular and anterior region rounded and; 1+1 secondary thickenings of gonapophyses IX T-shaped, medial region diamond-like; ductus receptaculi proximal subequal to the length of vesicular area; portion close to median wall of vesicular area enlarged; median wall slightly more enlarged apically than basally; ductus receptaculi distal funnel-shaped, as larger as capsula seminalis; anterior and posterior annular flanges convergent, both equal in width; pars intermedialis conical, enlarging apically, apical region

membranous. Capsula seminalis globose, slightly narrower than posterior annular flange (Figs. 26, 48).

**Male genitalia** (Figs. 27–31- 56–58, 80, 88, 96–98)**: Pygophore: Dorsal View**: Subretangular, longer than wide; genital cup not well exposed. Dorsal rim excavated trapezoidally; concave region lateral to median projection; median projection of dorsal rim with an acute sinuosity medially; mesial notch V-shaped; lateral margin straight; ventral rim slightly concave; posterolateral angles rounded, not produced; superior layer of ventral rim arched with a posterolateral tumescence extending into genital cup (Figs. 27, 56). **Posterior view**: Median projection of dorsal rim excavated in U-shape. Superior layer of ventral rim mesially excavated in a shallow V-shape; dorsal rim concave; lateral wall of genital cup bearing longitudinal grooves; inferior layer of ventral rim uniformly curved (Fig. 57). **Ventral view**: Posterior margin of ventral rim shallowly concave medially (Fig. 58). **Tenth segment:** Posterior margin trapezoidal; shallow transversal grooves at basal ⅔ ; bumps at the apical third slightly developed; setae concentrated apically and sparse laterally (Fig. 80). **Paramere:** Crown subequal in length and wider than stem; basal process of crown broad, rounded, setae uniformly distributed at the basal process surface; apical process slightly bent laterally; apex rounded, outer surface of inferior portion of apical region with scale-like microsculptures slightly more darker than surface of paramere. Ventral margin with emarginate region. Apex of apical process slightly higher than dorsal margin of basal process (Figs. 28, 88). Parameres divergent. **Phallus:** phallotheca piriform, constricted at apical third, constriction representing ¾ of apical width; posterodorsal margin concave; posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections. Process of phallotheca digitiform, slightly wider basally, divergent, not surpassing the conjunctiva. Vesica process gutter-like. Ductus seminis distalis long and spiral, almost twice longer than phallotheca; membranous region close to vesica process; conjunctiva quadrilobed, lobes of conjunctiva slightly sclerotized apically, forming small spines (Figs. 29-30- 31-96- 97-98).
**Distribution:** Canada (Ontario) United States of America **(**Arkansas, California,Colorado, Connecticut, Florida, Iowa, Illinois, Indiana, Massachusetts, Michigan, North Carolina, Nebraska, New Jersey, New York, Ohio, Oklahoma, Rhode Island, Texas, Utah, Vermont, Wisconsin).
**Remarks:** Some papers indicate *E. ictericus* bearing dark spiracles (McPherson, 1982; Rider, 2012; Paiero *et al*, 2013). The specimens from Florida State, USA, bear spiracles pale (Fig. 18). It may be a populational polymorphism commonly known for Pentatomidae (e.g. Esquivel *et al*. 2015; Barão *et al*. 2016; Roell *et al.* 2019).

***Euschistus* (*Euschistus*) *variolarius* (Palisot de Beauvois, 1817)**
(Figures 2, 10, 19, 34–35, 49, 59–61, 81, 89–101).
*Pentatoma variolaria* Palisot de Beauvois, 1817:149.
*Pentatoma punctipes* Say, 1825:314; Stål, 1872:26.
*Cimex sordidus* Herrich-Schaeffer, 1841:70; Stål, 1872:26.
*Dendrocoris punctipes*: Dohrn, 1859:14

**Material examined:** 2♀ USA/ Pennsylvania/ Monroe Co/ I-380& Route 940/ 6-7-VII-2011/ J. E. Eger//det. J. E. Rider, 2015//41º06'29.26"N, 75°/ 23'38.28"W, 1838ft// ♂ USA/ Pennsylvania Monroe Co/ I-380& Route 940/ 6-7-VII-2011/ J. E. Eger/ 41°06'29.26"N,75°/ 23'38.28"W,1838 ft/J. E. Eger Collection//♀ USA, North Dakota/ Ransom Co/ Mirror Pool Wildlife/ N A 46°32.348N 97°/ 17.475W/ 27 June 2012/ D. A. Rider//D. A. Rider Collection// ♂ USA, North Dakota, Cass Co/ Wild Rice/ R. at Red River/ 46 758N/ 96. 787 W/ 1.VIII.2012/ D. Rider. (Pygophore removed)/ D. A. Rider Collection// ♀ USA, Iowa/ Jeff Davis Parim/ W Jennings on Hwy 90/ 16-VII-1983/ D. A. Rider (Abdomen removed)/ D. A. Rider Collection// ♀ USA, New York, Ithaca/ Cornell. U/ Lot. 523/ Sub. 25//Cornell U./ Lot. 523/ Sub. 25// Ithaca/N/Y/ 7 Sept. 47/ Col. MRCN/001272//.

**Diagnosis:** Humeral angles often produced in 1+1 small spine, but sometimes slightly rounded (Fig.19); connexivum covered by hemelytra (Fig 2), pygophore with a medial black spot ventrally and a notable darker tumescent area extending into genital cup (Figs. 10-59-60-61). The medial region of gonapophyses IX arrow-like (Fig. 49).

**Redescription**

**General coloration:** Dorsal surface light brown to brown with black punctures (Fig. 2). Ventral surface from light brown to brown (Fig. 10). **Head:** Antennae red, at least ⅔ apex of antennomeres IV and V black. Ocelli reddish brown, surrounded by thin light brown to black band; area between ocelli and eyes unpunctured. A black band in front of the eyes in lateroventral view. **Thorax:** Posterior third of pronotum slightly darker than anterior portion. Anterior margin of pronotum lighter than pronotal disc. Cicatrices of pronotum concolour with pronotal disc, bearing few punctures. Humeral angles sometimes reddish. Punctures on scutellum becoming more sparse and smaller onto the apex; sometimes the apex of scutellum with an unpunctured and light brown area. Punctures more sparse and smaller at endocorium and onto the apex of forewings; membrane of hemelytra hyaline bearing small fumose spots. Ventrally presenting 1+1 black spot at anterior margin of propleurum, close to the eyes. Legs concolour with abdomen, often with black spots or dots at femur and tibia. **Abdomen:** Connexivum light brown to brown, with darker maculae at the anterior region. Spiracles concolours with ventral surface.

**Head:** Mandibular plates slightly longer than clypeus, both rounded apically. Anterior margin of bucculae rounded, posterior margin evanescent; the rounded portion with a concave surface. Antennomeres proportion: I<II=III<IV>V. Rostrum reaching the metacoxae. **Thorax:** Anterolateral margin of pronotum serrated, extending to ⅔ of anterolateral margin. Humeral angles often produced laterally as a small spine, but sometimes varying to slightly rounded (Fig. 19). Small foveas present. Evaporatorium surface unpunctured, extending onto posterior margin of mesopleuron, and more than halfway from ostiole to metapleural lateral margin; lateral fold present; shallow gyrification close the ostiole; ostiole gutiform; peritreme spout-like.

**Abdomen:** Connexivum covered by corium. Base of urosternite III presenting a slight tumescent area mesially. Posterolateral angles of urosternite VII projected as a spine.
**Female Genitalia** (34–35. 49)**: In Posterior view:** Gonocoxites VIII with few shallow punctures on the disc; mesial margins straight, not overlapped, elevated apically; posterior margin of gonocoxites VIII concave medially; posterolateral margin rounded and projected posteriorly, reaching middle of gonocoxites IX. Gonocoxites IX triangular, with lateral and posterior margins rounded, anterior straight; wider than long, crenulated surface bearing setae, but depressed triangular smooth area at the base (Fig. 34). **In posteroventral view**: posterior margin of gonocoxites VIII sinuose, shallowly concave at the middle, rounded posterolaterally and acute mesially, apex of mesial margin acute; laterotergites VIII projected and slightly rounded; laterotergites IX with triangular aspect; lateral and mesial margin straight, lateral margins convergent, mesial margins divergent; apex rounded, with some setae; apex surpassing the tergites VIII; both laterotergites VIII and IX reflexed apically; Segment X rectangular, longer than wide (Fig. 35). **Internal genitalia:** Ring sclerites fusiform; thickening of vaginal intima with posterior region triangular and anterior rounded; 1+1 secondary thickenings of gonapophyses IX T-shaped, medial region arrow-like; ductus receptaculi proximal longer than vesicular area; portion close to median wall of vesicular area enlarged; median wall slightly dilated basally and enlarged apically; ductus receptaculi distal funnel-shaped, narrower than capsula seminalis, anterior and posterior annular flanges convergent; posterior annular flange wider than anterior; pars intermedialis slightly conical, apical region membranose. Capsula seminalis globose, narrower than posterior annular flange (Fig. 49).

**Male genitalia** (Figs. 59–61, 81, 89, 99–101)**: Pygophore: Dorsal View**: Rectangular, longer than wide; genital cup well exposed; dorsal rim concave; median projection of dorsal rim with median sinuosity; lateral margins concave; ventral rim concave; posterolateral angles rounded, slightly developed; superior layer of ventral rim arched with a posterolateral darker tumescence extending into genital cup (Fig. 59). **Posterior view**: Median projection shallowly excavated in U-shape; superior layer of ventral rim mesially excavated in a shallow V-shape. Dorsal rim concave; lateral wall of genital cup with reduced longitudinal grooves; inferior layer of ventral rim curved uniformly (Fig. 60). **Ventral view:** circular black spot in the middle; posterior margin of ventral rim concave (Fig. 61). **Tenth segment:** Posterior margin trapezoidal; bumps at the apical third slightly developed; transversal grooves at basal ⅔; setae concentrated apically and slightly sparse laterally (Fig. 81). **Paramere:** Crown larger and wider than stem; basal process broad, rounded, with a small sharp projection oriented posterodorsally; setae concentrated at the margin of the basal process; apical process bent laterally, apex rounded; outer surface of inferior portion of apical region with scale-like microsculpture highly more darker than surface of paramere; ventral margin with emarginate region; apex of apical process not reach the dorsal margin of basal process; parameres divergent. **Phallus:** phallotheca piriform, constricted at apical third, representing ¾ of apical width; posterodorsal margin concave, posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections. Process of phalloteca slightly digitiform, wider

basally, divergent, bent ventrally, not surpassing the conjunctiva; Vesica process gutter-like. Ductus seminis distalis long and spiral; almost three times longer than phallotheca; membranous region close to vesica process; conjunctiva quadrilobed. Lobes of conjunctiva slightly sclerotized apically, forming spines (Figs. 99-100-101).

**Distribution:** Canada (British Columbia, Quebec); United States of America (Arkansas, Colorado, Connecticut, District of Columbia, Florida, Iowa, Idaho, Illinois, Indiana, Kansas, Massachusetts, Michigan, Missouri, North Carolina, New Hampshire, New Jersey, New York, New Mexico, Nebraska, Ohio, Oregon, Pennsylvania, Utah, Virginia).
**Remarks:** The general body shape is similar to *E. servus*, therefore, the female of *E. variolarius* is often confused with *E. servus* specimens. The laterotergites VIII of *E. variolarius* are slightly less acute than *E. servus*, and the median region of gonapophyses IX is arrow-like as *E. latimarginatus*. *E. servus* has the mandibular plates longer than clypeus (Paiero, 2013).

***Euschistus* (*Euschistus*) *servus* (Say, 1832)**
(Figures. 3, 4, 11–12, 21, 36-37, 39, 50–51, 62–67, 82–83, 90–91, 102–107).
*Pentatoma serva* Say, 1832: 4
*Pentatoma harrisii* Westwood, 1837 : 41; Van Duzee, 1916: 5
*Pentatoma spilota* Westwood, 1837: 42; Distant, 1901:811
*Euschistus impictiventris* Stål, 1872: 26; Rolston, 1978: 66
*Euschistus fissilis* Uhler, 1861:96; Van Duzee, 1916:5.
*Euschistus euschistoides* Vollenhoven, 1868:180 **New Synonymy**
*Euschistus servus euschistoides* Sailer, 1946: 158 **New Synonymy**
*Euschistus subimpunctatus* McAtee, 1919: 191; Sailer, 1961: 302
*Euschistus jugalis* Provancher, 1888:204 Van Duzee, 1917:40. (synonymized under *Euschistus impictiventris* by Van Duzee, 1917, Univ. Cal. Publ. Ent., 2: 40; Rolston (1974, above) placed that name in synonymy under *Euschistus servus.* Lectotype designated by Kelton, 1968, Nat. Can., 95: 1067).
*Euschistus* (*Euschistus*) *euschistoides*: Torre-Bueno, 1939:221.
*Euschistus servus servus*: Sailer, 1946:161
*Euschistus servus euschistoides*: Sailer, 1946: 161

**Material examined**: ♂ USA/ Louisiana/ Nathitoches Par/ Kisatchie Natl For/ 6 May 1989/ D.A Rider// D.A. Rider// ♂ USA/ Florida/ Leon Co/ II-VI-1970 [hw, white label]// Col. MRCN 002716// 1♀ 1♂ USA/ Louisiana/ Natch, Par/ Red Dirt Wildlife Man Area/ 9-IV-1988 [hw, white label]/ D. A Rider// D. A. Rider Collection// ♂ USA/ Louisiana/ St. Landru Parish/ 19-VI-1971 [hw, white label]// ♀ USA/ Louisiana/ St Landry Parish/ 16-VI-1971 [hw, white label]// ♀ USA/ Louisiana/ E Baton Rouge Par/ Siegen Lane at I-10, 29-IV-1983/ Coll, D. A. Rider// Collected by night sweeping// D. A. Rider Collection// ♀ USA/ Louisiana/ E. Baton Rouge Parish/ 1-IX-1969 [hw, white label]// L. H. Rolston Collection// col. MRCN 002715// 1♂ (Pygophore removed) 2♀ USA/ Minnesota/ Clay Co/

Moorhead Science Center/ 4-IX-2008/ Coll, D. A. Rider// D. A. Rider Collection // D. A. Rider Collection//1♀(Abdomen removed) 1♂ USA/ North Dakota/ Richland Co/ Shey. Nati GRsld. Horsetrl Head/ 46°31. 409N 97°12. 194W/ 4 Sept. 2009/ D. A. Rider// D. A. Rider// ♀ USA/ New York/ Ithaca/ 19, July, 1946// Coll F. Fernandez// Venezuela- Inst Zool/ Agricola-Fac. Agronomia Univ. Central//♂ USA/ Minnesota/ Clay Co Bluestem Prairie, western edge/ 10-IX-2009/ D. A. Rider;// ♀ USA/ Louisiana/ Baton Rouge Parish/ 1 IX 1969 [hw]//.

**Diagnosis:** Ductus receptaculi proximal at least three times longer than vesicular area (Figs. 50–51); ductus seminis distalis long coiled and more than three times longer than vesical process (Figs. 103, 106). The tenth segment has the bumps at the apical third well developed anterolaterally. Legs with small black spots (Figs. 11–12). Sinuosity of the median projection of pygophore less narrow than other species (Figs. 62–63, 65–66).

**Redescription**

**Coloration**. Dorsal surface light brown to brown. Ventral surface lighter than dorsal surface, light brown (Figs. 3–4, 11–12). **Head:** Antennae light brown to reddish brown, sometimes half of antennomeres IV and V dark brown. Ocelli reddish brown to light brown, often surrounded by thin black to reddish band. A black band in front of the eyes in lateroventral view. **Thorax:** Anterolateral margin of pronotum lighter than pronotal disc. Cicatrices concolour with pronotal disc, sometimes darker. Base of scutellum with small areas unpunctured. Punctures on scutellum becoming more sparse and smaller onto apex. Apex of scutellum with a pale area. Corium presenting punctures well distributed, sometimes more sparse and smaller toward the apex; membrane of hemelytra hyaline bearing small brown spots. Ventrally presenting 1+1 black spot at margin of propleurum, close to the eyes, and 1+1 black spots in propleurum, 2+2 black spots in mesopleurum and 1+1 black spots at metapleurum, but casually these spots can be absent. Legs concolour with ventral surface, black spots at base of setae, can be reduced among the specimens. **Abdomen:** Connexivum light brown, with dark band at anterior and posterior margin. Spiracles varying from concolour with ventral surface to dark brown.

**Head:** Mandibular plates subequal to slightly longer than clypeus; both rounded apically, clypeus slightly acuminate. Anterior margin of bucculae rounded, posterior margin evanescent; the rounded portion with concave surface. Antonnomeres proportion: I<II<III=IV≥V. Rostrum reaching the metacoxae. **Thorax:** anterolateral margin of pronotum denticulate, extending over half of anterolateral margin. Humeral angles varying from rounded to acute (Fig. 21). Small foveas present. Evaporatorium surface unpunctured, and spread onto posterior margin of mesopleuron, and more than halfway from ostiole to metapleural lateral margin; lateral fold present; gyrification over the whole evaporatorium surface; ostiole guttiform; peritreme spout-like. **Abdomen:** Conexivum can be exposed or

recovered by corium. Base of urosternite III presenting a slight tumescent area medially. Posterolateral angles of urosternite VII spinose.

**Female Genitalia** (Figs. 36–39, 50–51)**: In Posterior view:** Gonocoxites VIII with few little dark dots at disc; mesial margins straight, not overlapped, elevated apically; posterior margin of gonocoxites VIII concave medially; posterolateral margin rounded and projected posteriorly, surpassing the middle of gonocoxites IX. Gonocoxites IX triangular, posterior margins straight, lateral margin rounded, anterior slightly convex; wider than long; surface crenulated, with setae; depressed triangular smooth area at the base (Figs. 36–38). **In postero ventral view:** posterior margin of gonocoxites VIII sinuose, concave medially, rounded posterolaterally, apex of mesial margin acute; laterotergites VIII triangular, projected posteriorly and acute; laterotergites IX triangular, lateral and medial margin straight, lateral margins convergent, mesial margins divergent, apex rounded, with setae; apex surpassing the tergites VIII; both laterotergites VIII both laterotergites VIII and IX reflexed apically; segment X rectangular, longer than wide (Figs. 37–39). **Internal genitalia:** Ring sclerites fusiform, thickening of vaginal intima with posterior region triangular and anterior region rounded, 1+1 secondary thickenings of gonapophyses IX T-shaped, medial region diamond-like; ductus receptaculi proximal three times longer than vesicular area; portion close to median wall of vesicular area enlarged, vesicular area dilated bassaly and poorly enlarged apically; ductus receptaculi distal funnel-shape, smaller than capsula seminalis; anterior and posterior annular flanges divergent, both equal in width; pars intermedialis conical, apical and basal region membranose. Capsula seminalis ellipsoid, as wider as posterior annular flange (Figs. 50–51).

**Male Genitalia** (Figs. 62–67, 82–83, 90–91, 102–107) **Pygophore: Dorsal View:** Retangular, longer than wide; genital cup well exposed. Dorsal rim concave; median projection of dorsal rim with a concave sinuosity medially; lateral margin concave; ventral rim slightly concave; posterolateral angles rounded, slightly developed; superior layer of ventral rim arched with a posterolateral tumescence extending into genital cup (Figs. 62, 65). **Posterior view:** Median projection of dorsal rim excaved in U-Shaped. Superior layer of ventral rim medially excavated in opened V-shape; dorsal rim concave; lateral wall of genital cup bearing small longitudinal grooves; superior layer of ventral rim mesially excavated in a shallow V-shape, inferior layer of ventral rim uniformly curved (Figs. 63, 66). **Ventral view:** Posterior margin of ventral rim concave (Figs. 64, 67). **Tenth segment:** Posterior margin trapezoidal; transversal grooves slightly concave at basal ⅔; bumps at the apical third well developed;; setae concentrated at apical region and sparse laterally (Figs. 82–83). **Paramere:** Crown larger and wider than stem; basal process of crown broad, rounded; setae more concentrated at the margin of basal process; apical process bent laterally; apex rounded, outer surface in inferior portion of apical region with scale-like microsculpture more darker than surface of paramere; ventral margin with emarginate region. Dorsal margin of apical process not reaching dorsal margin of basal process. Parameres divergent (Figs.90–91). **Phallus:** phallotheca piriform, constricted at apical third, representing ¾ of apical width; posterodorsal

margin concave; posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections. Process of phallotheca digitiform, wider basally, divergent, slightly bent ventrally, not surpassing the conjunctiva. Vesica process gutter-like; ductus seminis distalis long and coiled, at least four times longer than phallotheca; membranous region close to vesica process; conjunctiva quadrilobed; lobes of conjunctiva slightly sclerotized apically, forming small spines (Figs. 102–107).

**Distribution:** Mexico. United States of America (Arizona, Arkansas, California, Colorado, Dakota, District of Columbia, Florida, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Missouri, New Jersey, North Carolina, New Mexico, New York, Ohio, Pennsylvania, South Carolina, Texas, Utah, Virginia)**.** Canada (Alberta, British Columbia, Manitoba, New Scotia, Quebec).

**Remarks:** Integrate population of subspecies of *E. servus* can be identified by the combination of the characters often used to separate the two subspecies (McPherson, 1982). This integration zone is located in a long belt from Maryland to Kansas (Sailer, 1954), but there are also reports in Virginia (Woodside, 1946; Hoffman, 1971;). *E. servus servus* occurs from southern to southeastern part of the United States of America and *E. servus euschistoides* from the northern part of the United States and Southern of Canada (Sailer, 1954; McPherson, 1982). The proposition that lead *E. servus* to have actually two subspecies was made by Sailer by means a small note *in* Woodside (1946b) which expressed that *E. servus* is a hybrid population of two subspecies *E. servus servus* and *E. servus euschistoides* (Vollenhoven, 1868). *E. servus servus* was revised by Rolston (1974) which includes only male genitalia in his analyses, illustrating some variations in humeral angles to this subspecies. McPherson and Ahmad (2012) examined the male genitalia of either *E. servus servus* and *E. servus euschistoides* sampling the distant populations, and did not noted structures with species-level significance, but kept the validity of both subspecies. As the male genitalia, the inclusion of internal and external female genitalia in our analyses showed a insignificant variation in the medial wall of vesicular area, (*i. e* in the southeastern population the base is more enlarged than apex, while the northern population, this structure is more enlarged at the base of medial wall of vesicular area (Figs. 50-51)). About general morphology, the humeral angles are rounded and the mandibular plates are subequal to the clypeus in the southeastern populations, as well as the conexivum well exposed. The northern population has the humeral angles slightly projected, conexivum recovered by corium and the mandibular plates surpassing the clypeus (Fig. 21). We are proposing the synonymy of *E. servus euschistoides.*

***Euschistus* (*Euschistus*) *tristigmus* (Say, 1832)**
(Figures. 5-6, 13–14, 22–23, 40–43, 52–53, 68–73, 84–85, 92–93, 108–113).
*Pentatoma tristigma* Say, 1832:4
*Pentatoma insconspecta* Westwood, 1837:42; Distant, 1903:812.
*Cimex pyrrhocerus* Herrich-Shaeffer, 1841:71; Stål, 1872:26.
*Mormidea pyrrhocerra*: Dohrn, 1859:14.

*Euschistus (Euschistus) tristigmus*: Stål, 1872:26.
*Euschistus luridus* Dallas, 1851:207.
*Euschistus tristigmus luridus* Dallas, 1851. **New Synonymy**
*Euschistus tristigmus tristigmus*: Van Duzee, 1904:47.
*Euschistus tristigmus* var. *pyrrhocerus*: Van Duzee, 1904:47
*Euschistus tristigmus luridus:* Sailer, 1949:163.

**Material examined:** ♂ USA/ Kansas/ Crawford Co/ 5 Mi. N/ Pittsburg/ Juno 16,1996/ J. & W. Ivie [hw, white label]// ♂ USA/ Missouri/ Camden Co/ south end Lake of the Ozarks/ July, 9, 1963/ J. & W. Ivie//1♂ 1 ♀ USA/ Louisiana/ Landry Parish/ 19 VII 1971 [hw, white label]// 1♀(Abdomen removed )1♂ USA/ Georgia/ Liberty Co/ St Catherines Island/ Sept. 18-21, 1972/ FC & BJ Thompson// ♂ USA/ Louisiana/ St. Landry Parish/ 8 VIII 1970// L. H. Rolston Collector// col. MRCN 002719// ♂ USA/ Arizona/ Sta Cruz Co/ 1 mi W/ Nogales/ 24 August 1987/ Coll D. A. Rider// D. A. Rider Collection// ♂USA/ Montana/ Washington, Mass/ Aug 21,04// A. P. Morse Coll// ♀ USA/ Louisiana/ East Feliciana Parish/ 12 VII 1970 [hw, white label]// J. Siqueira Collector//col. MRCN 002718// ♀Canada/ Orillia, Ont/ VII.IX 1938/ Collector C. H. Curran// ♀USA/ Connecticut/ New Canaan Fairfield Co/ Conn. VIII-12-1956/ M. Statham//

**Diagnosis.** Small unpunctured regions on dorsal surface that form pale spots (Figs. 5–6) Light brown unpunctured spot at the medial angles of cicatrices of pronotum. Apex of each tergite with black spot. Legs with black spots (Figs. 13–14). Secondary thickenings of gonapophyses IX spoon-like (Figs 52–53); Median projection of dorsal rim triangular (Figs. 68, 71). Apical process of parameres straight and ventral margin of paramere less emarginate than in other species of this group (Fig. 92–93).

**Coloration.** Dorsal surface light brown to brown, with brown to black punctures. Ventral surface light brown paler than dorsal surface. Unpunctured regions on dorsal surface forming pale spots (Figs. 5–6, 13–14). **Head:** Antennae light brown to reddish, sometimes antennomere V darker. Ocelli brownish, surrounded by thin darker band; area between ocelli and eyes unpunctured. A black band in front of the eyes in lateroventral view. **Thorax:** Anterolateral region of pronotum lighter than pronotal disc. Cicatrices of pronotum concolour with pronotal disc, bearing few punctures, medial angles of cicatrices of pronotum with light brown unpunctured spot; apex of humeral angles sometimes with reddish band. Punctures on scutellum becoming slightly more sparse and smaller into apex; base of scutellum often with unpuntered regions; apex of scutellum with a pale to reddish narrow area. Punctures more sparse and smaller at endocorium and onto the apex of forewings; membrane of hemelytra hyaline bearing small fumose spots. Ventrally presenting 1+1 black spot at margin of anterolateral region of pronotum. Propleurum presents 1+1 black spots, 2+2 black spots in mesopleurum and 1+1 black spots at metapleurum. Legs concolour with ventral surface, black spots at base of setae. Abdomen: Connexivum light brown, bearing a light brown macula mesially. Spiracle varying from pale to black. Transversal dark or pale band between

spiracle and tricobotria. Medially the ventral region of uroternites can vary in number of black spots: in females a small black line on the urosternite VII or in V to VII segments; in males on the medial region of uroternite VII but sometimes a small black spot at the VI. Apex of each tergite with black spot (Figs. 13–14).

**Head:** Clypeus equal to slightly longer than mandibular plates, both rounded apically and sometimes mandibular plates present an incision close to clypeus. Anterior margin of bucculae rounded, posterior margin evanescent; the rounded portion with a concave surface. Antennomeres proportion: I<II<III=V≤IV. Rostrum slightly surpassing the metacoxae. **Thorax:** Anterolateral margin of pronotum denticulated extending over half of anterolateral margin. Humeral angles varying from rounded to produced laterally in spine (Fig. 22). Small foveas present. Evaporatorium surface unpuntured, extending onto posterior margin of mesopleuron, and more than halfway from ostiole to metapleural lateral margin; lateral fold present; gyrification over the whole evaporatorium surface; ostiole guttiform; peritreme spout-like. **Abdomen:** Connexivum covered by corium. Base of urosternite III presenting a slight tumescent area mesially. Posterolateral angles of urosternite VII projected as a spine.

**Female genitalia** (40–42-43,52–53)**: In Posterior view:** Gonocoxites VIII often with few little dark dots at disc; mesial margins of gonocoxites VIII straight, not overlapped, elevated apically; posterior margin of gonocoxites VIII concave medially; posterolateral margins rounded and projected posteriorly, reaching the middle of gonocoxites IX. Gonocoxites IX triangular, lateral margins rounded, posterior margin slightly concave and anterior margin slightly convex; wider than long; surface crenulated with setae, depressed triangular smooth area at the base (40-42). **In Postero Ventral View:** posterior margin of gonocoxites VIII sinuose, slightly concave medially, rounded posterolaterally, apex of mesial margin acute. Laterotergites VIII diamond-shaped and projected as a spine with 1+1 reddish spot apically; laterotergites IX somewhat triangular; lateral and medial margin straight, rounded apically with some setae, apex surpassing the tergite VIII; both laterotergites VIII and IX reflexed apically; segment X subretangular, longer than wide (41-43). **Internal Genitalia:** Ring sclerites elliptical, thickening of vaginal intima with posterior region triangular and anterior region rounded, 1+1 secondary thickenings of gonapophyses IX spoon-like, medial region subtriangular; ductus receptaculi proximal smaller than vesicular area, portion close to median wall of vesicular area enlarged; median wall of vesicular area enlarged both basally and apically; ductus receptaculi distal funnel-shape; smaller than capsula seminalis; anterior and posterior annular flanges convergent; posterior wider than anterior; pars intermedialis slightly depressed medially, apical region membranose; capsula seminalis globose, narrower than posterior annular flange (Figs. 52–53).

**Male Genitalia** (Figs. 68–73, 84–85, 92–93, 108–113) **Pyghophore: Dorsal View:** Retangular, longer than wide; genital cup well exposed; dorsal rim concave; concave region lateral to median projection; median projection of dorsal rim pronounced, triangular; lateral margin concave; ventral rim with 1+1 small acute projection; posterolateral angles rounded, slightly developed, superior layer of ventral rim straight with a posterolateral tumescence

extending into genital cup (Figs. 68-71). **Posterior view:** Median projection pronounced with triangular aspect; superior layer of ventral rim excavated in shallow V-shaped. Dorsal rim concave; lateral wall of genital cup bearing reduced longitudinal grooves; inferior layer of ventral rim substraight (Figs. 69-72). **Ventral view:** Varying from 1+1 small lateral rounded projections to 1+1 lateral acute projections (Figs. 23, 70, 73) **Tenth segment:** Posterior margin trapezoidal; slightly transversal concaves grooves at basal ⅔; bumps at the apical third slightly developed; setae little expressive (Figs. 84–85). **Paramere:** Crown larger and wider than stem; basal process of crown broad, rounded; setae uniformly distributed at the basal process surface; apical process straight; apex rounded, outer surface in inferior portion of apical region with scale-like microsculpture concolour with surface of paramere; ventral margin with small emarginate region. Apex of apical process widely higher than dorsal margin of basal process; parameres parallel (Figs. 92–93). **Phallus:** phallotheca piriform, constricted at apical third, constriction representing ¾ of apical width; posterodorsal margin concave; posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections. Process of phallotheca digitiform, slightly wider basally, divergent, slightly bent ventrally, not surpassing the conjunctiva. Vesica process gutter-like. Ductus seminis distalis long and spiral, almost three times longer than phallotheca; membranous region close to vesica process; conjunctiva quadrilobed, lobes of conjunctiva slightly sclerotized apically, forming stout spines (Figs. 117–119).

**Distribuition:** Canada (Maritime Provinces, New Scotia, Ontario, Quebec) Mexico United States of America (Colorado, District of Columbia, District of Columbia, Florida, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Massachusetts, Maine, Michigan, Minnesota, Missouri, North Carolina, New Hampshire, New Jersey, New York, Nebraska, Ohio, Oklahoma, Pennsylvania, South Carolina, Virginia).

**Remarks:** Van Duzee (1904) considered *E. luridus* a strict synonym of *E. tristigmus*, considering *E. pyrrhocerus* (=*Cimex pyrrhocerus* Herrich-Schaeffer, 1842) as a variety. Hart and Malloch (1919) opined that *E. luridus* is different from *E. tristigmus* and highlighted the different forms in humeri (rounded in *E. luridus* and angular in *E. tristigmus*), and antennae (conspicuously darker in *E. luridus* than *E. tristigmus),* considering *E. pyrrhocerus* a distinct species. Blatchley (1926) considered *E. luridus*, *E. tristigmus* and *E. pyrrhocerus* as race or variety: "I cannot agree with Malloch that *luridus* is a distinct species, as large series show that it merges gradually into *tristigmus*. In my opinion it is best designated as a race or variety worthy of a trinomial name". Torre-Bueno (1939) synonymized *E. luridus* to *E.tristigmus* and considered *E. phyrrhocerus* a variety. Sailer *in* Esselbaugh (1949) by correspondence considered *E. luridus* and *E. tristigmus* valid subspecies, and *E. pyrrhocerus* a variety. Hoffman (1971) considered *E. luridus* as species, *E. tristigmus* and *E. pyrrhocerus* as subspecies. Lastly Mcpherson (1974) synonymized *E. pyrrhocerus* to *E. tristigmus* and since then no new taxonomic decision has been made. Rolston (1974) redescribed *E. tristigmus,* although it did not bring more details about the subspecies, the morphologic differences in humeral angles was treated as variation, and just like in *E. servus servus* it was only include

the male genitalia in that revisionary work. Mcpherson and Ahmad (2012) described the internal and external genitalia of both subspecies of *E. tristigmus* and did not find any with species-level significance, but kept the validity of either subspecies. Beside general morphology and male genitalia, we include female genitalia in our study.

***Euschistus (Euschistus) inflatus* Van Duzee, 1903**
(Figures 7, 15, 20, 44–45, 54, 74–76, 86, 94, 114–116).
*Euschistus inflatus* Van Duzee, 1903:107
*Euschistus (Euschistus) inflatus* Van Duzee, 1916:5

**Material examined:** ♀ USA/ Idaho/ Twin Falls, Id/ 3700ft Alt. 6-4-71//C. Wekeland. Id. Exp. Sta, Ae. No. 200// D. A. Rider Collection// ♀ USA/ Idaho/ Caldwell, Id Canyon Co/ 9-23-75// Collected by Dave Ward// D. A. Rider Collection// ♀ USA/ Utah/ Moab Ang/ 3-1942/ G. F. Knowlton// ♀ USA/ Arizona/ Cochise Co/ S. W. R. S/ 5 mi. W Portal 5400 ft/ July 8, 1955// E. Ordway Collector// ♀ USA/ Utah/ Juab Co/ Mt. Nebo Loop/ 12 July 1968/ G. F. Knowlton// det. J. E. Eger, 2015 (Abdomen removed)// ♀USA/ New Mexico/ Lincoln Co/ Cedar Creek Camp/ 2 miles/ N. Ruidoso/ June 30 1961/ 7000 ft/ F., P & J. Rindge (Abdomen removed)// ♀ USA/ Utah/ Logan Marsh/ 8-16-1950/ Ken E. Wolf// det. J. E. Eger, 2015// J. E. Eger Collection (Abdomen removed)// ♂ USA/ Arizona/ Cochise Co/ Cave Gr. Sunny Flat/ 13 Sep 1980/ Hanson & Knowlton// det. J. E. Eger, 2015// J. E. Eger Collection// ♂ USA/ Utah/ Rock Ck/ Cayn, nr, Provo/ VII-30-1986/ L. B. O'Brien// Det. L. H. Rolston 1990// D. A. Rider Collection (Pygophore removed) // 2♂ USA/ Arizona/ Coconino Co/ 17 mi/ 6000ft/ S. Flagstaff, Oak Creek Canyon/, July 27, 1950//T. Cohn, P. Boone, M. Cazier Collectors (pyhophore removed)// ♂ USA/ Idaho/ Caldwell 5-32 [hw, white label]// Tucker, H.M// D. A. Rider Collection// ♂ USA/ Arizona/ Cochise Co/ S. W. R. S/, 5 mi W/ Portal 5400 ft/ Sept, 30, 1956/ E. Ordway Collector// ♂ USA/ Utah/ Washington Co/ Leeds Cayon/ 15 Jul 1980/ Hanson Knowlton & Clemons//det. J. E. Eger, 2015//J. E. Eger Collection (Pyghophore removed)//.

**Diagnosis:** This species can be diagnosed by the combination of de following characters: apex of V antennomere black, humeral angles slightly acute, not as spine, connexivum widely exposed, small black spots distributed through the dorsal surface mainly at the corium and the scutellum without a notable pale region at the apex (Fig. 7).

**Redescription**
**Coloration:** Dorsal surface brown to orangish brown with black punctures. Ventral surface orange to orangish brown presenting irregular spots heterogeneously distributed (Figs. 7-15). **Head**: Antennae orangish brown to brown, antennomere V black apically. Ocelli red, surrounded by a thin dark band; unpunctured area between ocelli and eyes extending onto the base of the head. A black band in front of the eyes in lateroventral view. **Thorax:** Anterior margin of pronotum slightly lighter than pronotal disc, becoming reddish toward the

humeral angles. Cicatrices of pronotum concolour with pronotal disc. Punctures on scutellum becoming more sparse onto apex. Corium presenting punctures homogeneously distributed; membrane of hemelytra fumose to brownish bearing small brown spots. Ventrally presenting 1+1 black spot at anterior margin of propleurum, close to the eye, and 1+1 black spots on supracoxal cleft on mesopleurum; 1+1 at supracoxal cleft and another 1+1 laterally on mesopleurum; on metapleurum 1+1 at base of evaporatorium. Evaporatorium presenting irregular spots darker than metapleurum. Legs concolour with ventral surface, femora presenting sparse tiny spots. **Abdomen:** Connexivum dark brown, with a pale band between the anterior and posterior angles. Red to brown irregular spots over the whole ventral surface; tergites sometimes presenting the anterior angle with dark spot; Spiracles varying from pale to black (Fig. 20).

**Head:** Mandibular plates subequal to slightly longer than clypeus. Mandibular plates slightly deflected and varying from rounded to acute, but never pointed. Clypeus rounded apically. Anterior margin of bucculae rounded, posterior margin evanescent; the rounded portion with a concave surface. Antennomeres proportion: I<II<III=V=IV. Rostrum slightly reaching the metacoxae. **Thorax:** anterolateral margin of pronotum crenulated, extending over half of anterolateral margin. Humeral angles produced laterally, slightly acute, but not as a spine (Fig. 7). Small foveas present. Evaporatorium surface unpunctured, extending onto posterior margin of mesopleuron, and more than halfway from ostiole to metapleural lateral margin; lateral fold present; gyrification over the whole evaporatorium surface; ostiole guttiform; peritreme spout-like. **Abdomen:** Connexivum well exposed. Base of urosternite III presenting a slight tumescent area mesially. Posterolateral angles of urosternite VII projected asin a spine.

**Female Genitalia** (44–45, 54)**: In posterior view:** Gonocoxites VIII presenting few shallow punctures at disc; mesial margins straight at base, not overlapped, and elevated apically; posterior margin of gonocoxites VIII concave mesially, posterolateral margins rounded and projected posteriorly, reaching the middle of gonocoxites IX. Gonocoxites IX trapezoid, lateral margins rounded, anterior slightly concave, and posterior subconcave; wider than long; surface crenulated, with setae, depressed triangular smooth area at the base (Fig. 44). **In posteroventral view:** posterior margin of gonocoxites VIII sinuose, concave medially, rounded posterolaterally, apex of mesial margin acute. Laterotergites VIII with triangular aspect; laterotergites IX somewhat triangular; lateral and mesial margin straight, apex rounded with some setae, apex surpassing the tergites VIII; both laterotergites VIII and IX reflexed apically; mesial margin of laterotergites IX parallel; segment X rectangular, longer than wide (Fig. 45). **Internal genitalia:** Ring sclerites fusiform; thickening of vaginal intima with posterior region triangular and anterior region rounded; 1+1 secondary thickenings of gonapophyses IX T-shaped, medial region diamond-like; ductus receptaculi proximal twice longer than vesicular area; portion close to median wall of vesicular area enlarged; median wall of vesicular area enlarged appiccally ductus receptaculi distal funnel-shape; anterior and posterior annular flanges convergent; pars intermedialis slightly conical, apical region membranose. Capsula seminalis globose, narrower than posterior annular flange (Fig. 54).

**Male Genitalia** (74–76, 86, 94, 114–116)**: Pygophore: Dorsal view:** Retangular, longer than wide; genital cup well exposed. Dorsal rim concave; median projection with a median sinuosity; lateral margin concave; ventral rim with a slightly sinuosity; posterolateral angles rounded, slightly developed; superior layer of ventral rim arched with a slightly posterolateral tumescence extending into genital cup (Fig. 74). **Posterior view**: Median projection of dorsal rim excavated in shallow U-shape. Superior layers of ventral rim medially excavated in V-shape; dorsal rim uniformly curved; lateral wall of genital cup bearing longitudinal grooves; inferior layer of ventral rim uniformly concave (Fig. 75). **Ventral view**: Posterior margin of ventral rim slightly concave (Fig. 76). **Tenth segment:** Posterior margin trapezoid; transversal slightly concaves grooves at basal ⅔; bumps at the apical third well developed; setae concentrated both at the apical region than laterally (Fig. 86). **Paramere:** Crown larger and wider than stem; basal process of crown broad, rounded and directed anteriorly; setae more concentrated at the margin of the basal process; apical process slightly bent laterally, apex rounded, outer surface in inferior portion of apical region with scale-like microsculpture concolour with surface of paramere; ventral margin with emarginate region. Apex of apical process not reach dorsal margin of basal process; parameres divergent (Fig. 94). **Phallus:** phallotheca piriform constricted at apical third, constriction representing ¾ of apical width. Posterodorsal margin concave; posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections; Process of phallotheca digitiform, slightly wider basally, divergent, slightly bent ventrally, not surpassing the conjunctiva. Vesica process gutter-like. Ductus seminis distalis long and spiral almost three times longer than phallotheca, membranous region close to vesica process; conjunctiva quadrilobed, lobes of conjunctiva slightly sclerotized apically, forming small spines (Figs. 114-115-116).

**Distribuiton:** United States of America (California, Colorado, New Mexico, Utah).

**Remarks:** The body is ovoid, it is similar to *E. latimarginatus*. Both species with connexivum widely exposed. However in *E. latimarginatus* the connexivum is immaculate and in *E. inflatus* with a pale band between the anterior and posterior angles. *Euschistus inflatus* showed no variation in the humeral angles as other species of this group, being this produced laterally and slightly acute.

***Euschistus (Euschistus) latimarginatus* Zimmer, 1910**
(Figures 8, 16, 24, 46–47, 55, 77–79, 87, 95, 117–119)
*Euschistus latimarginatus* Zimmer, 1910:167.
*Euschistus (Euschistus) latimarginatus*: Van Duzee, 1916:5.
**Material examined:** ♂ USA/ Nebraska/ Cherry Co/ Valentine/ 14 Jul. 1986/ T. J Henry & A. G. Wheeler, Jr// USNMNH-2068400// ♂ USA/ Colorado/ Wray/ Aug/ 17. 19. 1919// About 40° 0’ N. 102° 10’ W. 3700 ft.// ♂ USA/ Nebraska/ Det. D. A. Rider 1990// Sterling [hw, white label]// (USNMNH-2068400)// 1♂1♀ USA/ Nebraska/ Hall Co/ Cairo Rt/ 2. 12 Jul. 1986/ T. J. Henry & A. G. Wheeler, Jr// Taken on Oenothera sp.// ♀ USA/ Nebraska/ Hall Co/ Cairo Rt/ 2, 12 Jul. 1986/ T. J. Henry & A. G. Wheeler, Jr// (Abdomen removed). Taken

on Oenothera sp.//(USNMNH-2068400)//det D.A. Rider 1999// (USMMNH- 2068400)// 3♂ USA, Nebraska, Halsey/ National Forest/July 24 , 1969/ Ex yucca/ K.P Pruess// det. J E. Eger// ♂ USA/ New Mexico/ Elk/ N.M/ Chavez Co/ VII-25-1957/ C.W O'Brien (AMNH)// ♀ USA/ Oklahoma/ Erick/ 4-VII-1965/ [hw, white label] / Rosenberg Collection// det. J. E. Eger// J. E. Eger Collection// ♀ USA/ Nebraska/ Hall Co Cairo/ Rt/ 2, 12 Jul 1986/ T.J. Henry & A. G. Wheeler, Jr// Taken on Oenothera sp.//(USNMNH-2068400)// 2♀ USA/ Nebraska/ Halsey/ 12-VI-1971/ On Yucca/ K. Pruess, Coll// D. A. Rider Collection//♀ USA/ Nebraska/ Hall Co/ Cairo/ Rt/ 2. 12 Jul, 1986/ T. J. Henry & A. G. Wheeler, Jr// Taken on Oenothera sp.// (USNMNH-2068400)//

**Diagnosis:** Half of antennomeres IV and V black; dense band of punctures at the anterolateral and margin of pronotum; Connexivum widely exposed and immaculate (Fig. 8). Ventral surface immaculate (Fig. 16). Membrane of hemelytra immaculate.

**Coloration:** Dorsal surface light brown to brown with brown to black punctures. Ventral surface slightly paler than dorsal, immaculate (Figs. 8-16). **Head:** Antennae brown, half of antennomeres IV and V black. Ocelli reddish to brown, surrounded by thin black and sometimes light brown band; area between ocelli and eyes unpunctured. A black band in front of the eyes in lateroventral view. **Thorax:** Anterolateral margin of pronotum lighter than pronotal disc. Dense band of punctures at the anterolateral margin of pronotum. Cicatrices of pronotum concolour with pronotal disc, bearing few punctures. Punctures becoming more sparse and smaller onto apex of scutellum, apex unpunctured. Punctures more sparse and smaller at endocorium and onto the apex of forewings; membrane of hemelytra hyaline bearing small fumose spots. Ventrally presenting 1+1 black spot at anterior margin of propleurum, close to the eyes and 1+1 black spots on supracoxal cleft; on mesopleurum 1+1 at supracoxal cleft and another 1+1 laterally; on metapleurum 1+1 at base of evaporatorium. Legs concolour with ventral surface. Spots at base of setae. **Abdomen:** Connexivum light brown, immaculate. Spiracles pale than surface. Vertical black macula among spiracles and trichobothria.

**Head:** Mandibular plates longer than clypeus. Mandibular plates acute, but never pointed. Clypeus rounded apically.. Anterior margin of bucculae rounded, posterior margin evanescent; the rounded portion with a concave surface. Antennomeres proportion: I<II=III>IV=V. Rostrum reaching the metacoxae. **Thorax:** Anterolateral margin of pronotum straight, and serrated, extending at least to half of anterolateral margin. Humeral angles slightly produced laterally, usually presenting a short acute spine but sometimes being slightly rounded (Fig. 24). Small foveas present. Evaporatorium surface unpunctured, extending onto posterior margin of mesopleuron, and more than halfway from ostiole to metapleural lateral margin; lateral fold present; gyrification over the whole evaporatorium surface; ostiole guttiform; spout peritreme. **Abdomen:** Connexivum well exposed. Base of

urosternite III presenting a slight tumescent area mesially. Posterolateral angles of urosternite VII projected as a spine.

**Female Genitalia** (46–47, 55)**: Posterior view:** Gonocoxites VIII with few shallow punctures on the disc, but without spots; mesial margins straight, not overlapped, and elevated apically; posterior margin of gonocoxites VIII concave mesially; posterolateral margins rounded and projected posteriorly, reaching the middle of gonocoxites IX; Gonocoxites IX trapezoid, lateral margins rounded, anterior margin slightly convex, and posterior margin slightly concave; twice wider than long; surface crenulated, with setae; depressed triangular smooth area at the base (Fig. 46). **In postero ventral view:** posterior margin of gonocoxites VIII sinuose, concave medially, rounded posterolaterally, apex of mesial margin acute. Laterotergites VIII diamond-shaped and posteriorly projected as a stout spine; laterotergites IX somewhat triangular; lateral and mesial margin straight, rounded apex with some setae, apex surpassing the tergites VIII; both laterotergites VIII and IX reflexed apically; segment X rectangular, longer than wide (Fig. 47). **Internal genitalia:** Ring sclerites fusiform; thickening of vaginal intima with posterior region triangular and anterior rounded; 1+1 secondary thickenings of gonapophyses IX T-shaped, medial region triangular; ductus receptaculi proximal larger than vesicular area; portion close to median wall of vesicular area enlarged; median wall of vesicular area enlarged at apex; ductus receptaculi distal funnel-shaped; anterior and posterior annular flanges convergent, both equal in width; pars intermedialis slightly conical, apical region membranose. Capsula seminalis globose, narrower than posterior annular flange (Fig. 55).

**Male Genitalia** (Figs. 77–79, 87, 95, 117–119). **Pygophore: Dorsal view:** Retangular, longer than wide; genital cup well exposed; dorsal rim concave; median projection of dorsal rim with a median sinuosity; lateral margin straight; ventral rim slightly concave; posterolateral angles rounded, slightly developed; superior layer of ventral rim arched with a posterolateral tumescence extending into genital cup (Fig. 77). **Posterior view**: Median projection of dorsal rim excaved in U-shaped Superior layers of ventral rim medially excavated in V-shape; lateral wall of genital cup bearing reduced longitudinal grooves, inferior layer of ventral rim uniformly curved (Fig. 78).**Ventral view**: Posterior margin of ventral rim slightly concave (Fig. 79). **Tenth segment:** Posterior margin trapezoid; transversal slightly concaves grooves at basal 2/3; bumps at the apical third slightly developed; setae concentrated apically and laterally (Fig. 87). **Paramere:** Crown larger and wider than stem; basal process of crown broad, rounded and directed anteriorly; setae more concentrated at the margin of the basal process; apical process bent laterally and the apical region slightly bent ventrally; apex rounded, outer surface in inferior portion of apical region with scale-like microsculpture darker than surface of paramere; Ventral margin with emarginate region. Apex of apical process not reaching dorsal margin of basal process. Parameres divergent (Fig. 95). **Phallus:** phallotheca piriform, constricted at apical third, constriction representing ¾ of apical width; posterodorsal margin concave; posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections. Process of phallotheca digitiform, slightly wider basally, divergent,slightly bent ventrally, not surpassing

the conjunctiva. Vesica process gutter-like. Ductus seminis distalis long and coiled, almost three times longer than phallotheca; conjunctiva quadrilobed, lobes of conjunctiva slightly sclerotized apically, forming small spines (Figs. 117–119).

**Distribuiton:** United States of America (Colorado, Nebraska, Minnesota, Kansas, North Dakota)

**Remarks:** This is a characteristic species within the group because of the connexivum widely exposed and immaculated as well as the membrane of hemelytra without maculas. It is quite similar to *E. inflatus* although the body is less ovoid and the mandibular plates are surpassing the clypeus.

**Final remarks:**

We explored the external and internal morphology of those species grouped by Stål, adding to them other two species posteriorly described, to compose the ictericus group. Our scrutiny points out several shared characteristics other than those stated by him related to external morphology. The male and female genitalia are much more homogeneous among them than other congeneric species. Although *E. tristigmus* share some similarity to this group, we considered this species out of a found pattern of the group, mainly those genital characters (i.e. in the female genitalia: laterotergites VIII more acute than other species, with black spots at the apex; secondary thickenings of gonapophyses IX spoon like, ductus receptaculi proximal is shorter than vesicular area. In the pygophore: median projection of dorsal rim is triangular; posterior margin of ventral rim with 1+1 small lateral rounded or acute projections; the apical process of paramere is straight, the apex of apical process is widely higher than dorsal margin of basal process, the emarginate region at the ventral margin of paramere is notably reduced; lobes of conjunctiva bearing stout spines).

The ictericus group is composed by *E. ictericus*, *E. variolarius*, *E. servus*, *E. inflatus* and *E. latimarginatus,* and share the following characteristics of genitalic structures: **Genital plates: In Posterior View:** Posterior margin of gonocoxites VIII concave mesially; posterolateral margins rounded and projected posteriorly, reaching the middle of gonocoxites IX; gonocoxites IX trapezoid, lateral margins rounded, anterior margin slightly convex, and posterior margin slightly concave; twice wider than long; surface crenulated, with setae; depressed triangular smooth area at the base. **In postero ventral view:** posterior margin of gonocoxites VIII sinuose, concave medially, rounded posterolaterally, apex of mesial margin slightly acute; Laterotergites VIII diamond-shaped and posteriorly projected as a spine. Laterotergites VIII diamond-shaped and posteriorly projected as a stout spine; laterotergites IX with triangular aspect; lateral and mesial margin straight, rounded apex with some setae, apex surpassing the tergites VIII; tenth segment rectangular, longer than wide. **Internal genitalia:** 1+1 secondary thickenings of gonapophyses IX T-shaped; ductus receptaculi proximal subequal or slightly longer than vesicular area (in *E. servus* three times longer); portion close to median wall of vesicular area enlarged; median wall of vesicular area enlarged appiccally; ductus receptaculi distal funnel-shape; anterior and posterior annular

flanges convergent; pars intermedialis slightly conical, often depressed medially, apical region membranose. Capsula seminalis globose, narrower than posterior annular flange. **Male Genitalia: Pygophore: Dorsal view:** Retangular, longer than wide; genital cup well exposed (in *E. ictericus* less exposed than in other species); Dorsal rim concave; median projection with a median sinuosity; lateral margin concave; ventral rim with a slightly sinuosity (in *E. ictericus* the dorsal rim of pygophore is flanked by lateral concavities); posterolateral angles rounded, slightly developed; superior layer of ventral rim arched with a slightly posterolateral tumescence extending into genital cup. **Posterior view:** Median projection of dorsal rim excavated in U-shaped; superior layers of ventral rim medially excavated in V or U-shape; lateral wall of genital cup bearing longitudinal grooves; inferior layer of ventral rim uniformly curved (Fig. 78). Ventral view: Posterior margin of ventral rim slightly concave. **Tenth segment:** Posterior margin trapezoid; transversal slightly concave grooves at basal 2/3; bumps at the apical third slightly developed (in *E. servus* well developed); setae concentrated apically and laterally. **Paramere:** Crown larger (in *E. ictericus* subequal) and wider than stem; basal process broad, rounded; setae concentrated at the margin of the basal process; apical process bent laterally apex rounded; outer surface in inferior portion of apical region with scale-like microsculptures varying from concolour with surface of paramere to highly darker; ventral margin with emarginate region; Apex of apical process slightly higher or not reaching dorsal margin. **Phallus:** phallotheca piriform, constricted at apical third, constriction representing ¾ of apical width; posterodorsal margin concave; posterolateral angles projected and rounded; basal process of phallotheca with 1+1 projections; Process of phallotheca digitiform, slightly wider basally, divergent, slightly bent ventrally, not surpassing the conjunctiva. Vesica process gutter-like. Ductus seminis distalis long and spiral almost three times longer than phallotheca (at least four times longer than phallotheca in *E. servus*); membranous region close to vesica process; conjunctiva quadrilobed, lobes of conjunctiva slightly sclerotized apically forming small spines.

*Euschistus tristigmus luridus* is considered a junior synonym of its nominal subspecies, and also *E. servus esuchistoides* junior synonym of *E. servus servus.* Here we formally propose the ictericus group composed of five species mostly distributed in the Nearctic region. The next step is to test the ictericus group under a phylogenetic perspective, and also hypothesize phylogenetic relationships within the *Euschistus* (*Euschistus*).

**Acknowledgments**

We are thankful to the curators of the scientific collections for the loan of specimens; to coordenação de Aperfeiçoamento de Pessoal de Nível Superior—CAPES Financial code 001 granted to M. R. Paim.

**References**

Baker, A.D. 1931. A study of the male genitalia of canadian species of Pentatomidae. Canadian Journal of Research, **1:**181–219.

Barão, K.R., Garbelotto, T.D.A., Campos, L.A, and Grazia, J. 2016. Unusual looking pentatomids: reassessing the taxonomy of *Braunus* Distant and *Lojus* McDonald (Hemiptera: Heteroptera: Pentatomidae). Zootaxa, **4878 (1):** 168–186.

Bianchi, F.M.,Deprá, M., Ferrari, A., Grazia. J., Valente, V.L.S., and Campos., L.A. 2017a. Total evidence phylogenetic analysis and reclassification of *Euschistus* Dallas within Carpocorini (Hemiptera; Pentatomidae: Pentatominae). Systematic Entomology, **42:** 399–409.

Bianchi, F.M., Barão, K.R., Grazia, J. 2017b. Review of the sulcacitus group of *Euschistus* (Pentatomidae: Pentatominae: Carpocorini) with description of the internal female genitalia and a new species. Zootaxa, **3:** 348–358.

Blatchley, W.S. 1926. Heteroptera or true bugs of easter North America with especial reference to the faunas of Indiana and Florida. The Nature Publish Company, Indianapolis.

Bundy, C.S. 2014 An Annotated Checklist of the Stink Bugs (Heteroptera: Pentatomidae) of New Mexico. The Great Lakes Entomologist, **45:** 196–209.

Cioato, A., Bianchi, F.M., Eger, J. and Grazia, J. 2015. New species of *Euschistus (Euschistus)* from Jamaica, *Euschistus (Mitripus)* and *Ladeaschistus* from southern South America (Hemiptera: Heteroptera: Pentatomidae: Pentatominae). Zootaxa, **4:** 565–574.

De Queiroz, K. 2007. Species concepts and species delimitation. Systematic biology, **56 (6)**:879–886.

Deans, A.R., Yoder, M.J., and Balhoff, J.P. 2012. Time to change how we describe biodiversity. Trends in Ecology and Evolution, **27 (2)**: 78–84.

Dupuis, C. 1970. Heteroptera. *In* Taxonomist's glossary of genitalia in insects. *Edited by* S. L. Tuxen. Munksgaard, Copenhagen. Pp. 190–209.

Esquivel, J.F., Brown, V.A., Harvey, R.B., and Droleskey, R.E. 2015. A black color morph of adult *Nezara viridula* (L.) 1. Southwestern Entomologist, **3:** 649–653.

Esselbaugh, C.O. 1949. A bionomic note on the taxonomic status of the form *pyrrhocerus* of *Euschistus tristigmus* Say. Proceedings of the Entomological Society of Washington, **51:** 160–163.

Froeschner, R.C. and Henry, T.J. 1988. Genus *Euschistus* Dallas, 1851. *In:* Catalog of the Heteroptera, or True Bugs of Canada and the Continental United States. *Edited by* T.J. Henry and R.C. Froeschner. E.J. Brill, Leiden, New York, Kobenhavn, Koln. Pp. 576–580.

Hoffman, R.L. 1971. The Insects of Virginia: No. 4. Shield bugs (Hemiptera; Scutelleroidea, Corimelaenidae, Cydnidae, Pentatomidae). Virginia Polytechnic Institute and State University, Research Division Bulletin.

Koch, R.L., Rider, D., Tinerella, P.P., Rich, W.A. 2014. Stink bugs (Hemiptera: Heteroptera: Pentatomidae) of Minnesota: an annotated checklist and new state records. The Great Lakes Entomologist, **47:** 171–185

Kment, P. 2012. Redescription of the Madagascan endemic genus *Anoano* with a new synonymy (Hemiptera: Heteroptera: Pentatomidae). Acta Entomologica Musei Nationalis Pragae, **52:** 371–382.

Linnaeus, C.V. 1763. Centuria insectorum rariorum. Amoenitates academicae, **6:** 384–415.

Hart. C.A. and Malloch, J.R. 1919. *Euschistus* Dall.; Key to Species. *In* The Pentatomoidea of Illinois with keys to the Nearctic genera. Illinnois Natural History Survey Bulletin, **13:**189–191.

McPherson, J.E. 1982. The Pentatomoidea (Hemiptera) of northeastern North America with emphasis on the fauna of Illinois. Southern Illinois University Press, Carbondale.

McPherson, J.E., and Ahmad, I. 2012. Comparison of male genitalia of *Euschistus* spp. in the Midwestern United States (Hemiptera: Heteroptera: Pentatomidae). Annals of the Entomological Society of America, **105 (3):** 395–402.

Rider, D.A. 2012. The Heteroptera (Hemiptera) of North Dakota I: Pentatomomorpha: Pentatomoidea. The Great Lakes Entomologist, **45:** 312–380.

Paiero, S.M. Marshall, S.A. McPherson, J.E. and M.-S. Ma. 2013. Stink bugs (Pentatomidae) and parent bugs (Acanthosomatidae) of Ontario and adjacent areas: A key to species and a review of the fauna. Canadian Journal of Arthropod Identification, **24:** 1–183.

Packauskas, R.J. 2012 The Pentatomidae, or stink bugs, of Kansas with a key to species (Hemiptera: Heteroptera). The Great Lakes Entomologist, **45:** 210–219.

Panizzi, A.R., McPherson, J.E., James, D.G., Javahery, M., Robert M., and McPherson, R.M. 2000 Stink bugs (Pentatomidae). *In:* Heteroptera of economic importance. *Edited by* C.W. Schaefer. and A.R. Panizzi. CRC Press, Boca Raton. Pp. 421–474.

Roell, T., Lemaître, V.A., and Webb, M.D. 2019. Revision of the African shieldbug genus *Afrius* Stål, 1870 (Hemiptera: Heteroptera: Pentatomidae: Asopinae). European Journal of Taxonomy. **520:** 1–44.

Rolston, L.H. 1974. Revision of the genus *Euschistus* in Middle America (Hemiptera, Pentatomidae, Pentatomini). Entomologica Americana, **48:** 1–102.

Rolston, L.H. 1984. Key to the males of the nominate subgenus of *Euschistus* in South America, with descriptions of three new species. (Hemiptera: Pentatomidae). Journal of the New York Entomological Society, **92:** 352–364.

Sailer, R.I., 1954. Interspecific Hybridization among insects with a report on crossbreeding experiments with stink bugs. Journal of Economic Entomology, **47:** 377–383.

Smaniotto L.F, Panizzi A.R 2015. Interactions of selected species of stink bugs (Hemiptera: Heteroptera: Pentatomidae) from leguminous crops with plants in the Neotropics. Florida Entomologist, **98:**7–17.

Stål, C. 1872. Enumeratio Hemipterorum, Enumeratio Cimicinorum Americae. Kongliga Svenska Vetenskaps-Akademiens Handlingar, **10:** 3–65.

Torre-Bueno, J. R. de la. 1939. A synopsis of the Hemiptera-Heteroptera of America north of Mexico. Part I Families Scutelleridae, Cydnidae, Pentatomidae, Aradidae, Dysodiidae and Temitaphididae. Entomologica Americana. **19:** 141–304.

Tsai, J.F., Rédei, D., Yeh, G.F. and Yang, M.M. 2011. Jewel bugs if Taiwan (Heteroptera: Scutelleridae). National Chung Hsing University, Taichung, 309.

Van Duzee, E. P. 1904. Annotated list of the Pentatomidae recorded from America north of Mexico, with descriptions of some new species. Transactions of the American Entomological Society **30 (1):** 1–80.

Weiler, L., Ferrari, A. and Grazia, J. 2016 Phylogeny and biogeography of the South American subgenus *Euschistus* (*Lycipta*) Stål (Heteroptera: Pentatomidae: Carpocorini). Insect Systematics & Evolution, **47:** 313–346.

Woodside, A. M. 1946. Cat-faving and dimpling in peaches. Journal of Economic Entomology. **39:** 156–161.

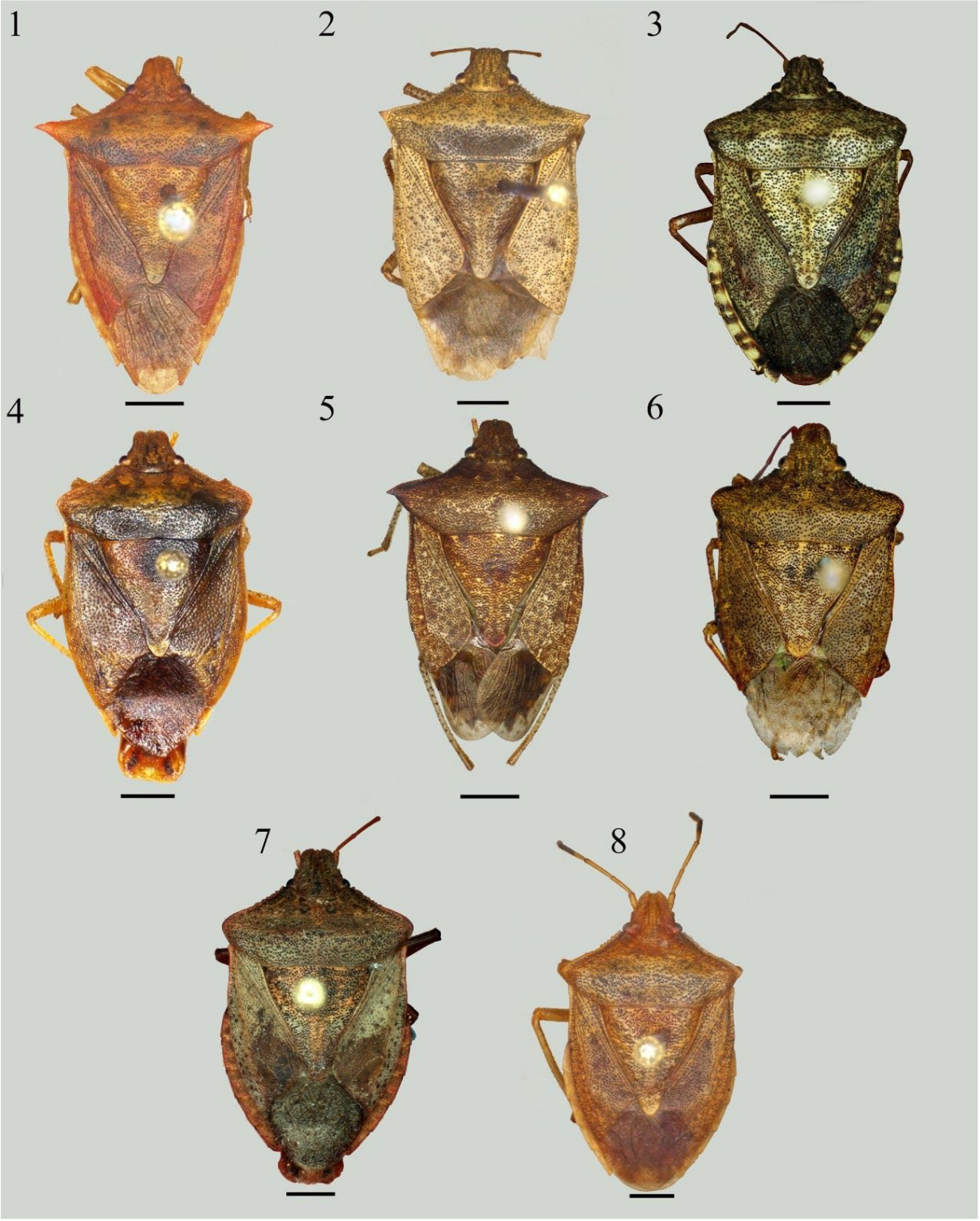
Woodside, A. M. 1946b. Life History studies of *Euschistus servus* and *E. tristigmus*. Journal of Economic Entomology. **39:** 161–163.

| | *E. ictericus* | | *E. variolarius* | | *E. s. servus* | | *E. s. euschistoides* | |
|---|---|---|---|---|---|---|---|---|
| | Male (n=4) | Female (n=6) | Male (n=2) | Female (n=5) | Male (n=4) | Female (n=4) | Male (n=3) | Female (n=5) |
| BL | 11.20 ± 0.8 (10.13-12.38) | | 12.80 ± 0.58 (12.00-13.38) | | 10.51 ± 0.77 (9.00-13.00) | | 11.7 ± 0.80 (8.60-10.50) | |
| AW | 5.88 ± 0. 66 (5.13-6.38) | | 7.03 ± 0.33 (6.75-7.50) | | 5.89 ± 0.48 (5.20-6.50) | | 5.54 ± 0.33 (5.10-6.10) | |
| HW | 2.29 ± 0.16 (2.13-2.44) | | 2.52 ± 0.17 (2.25-2.75) | | 2.11 ± 0.10 (2.00-2.30) | | 2.05 ± 0.05 (2.00-2.10) | |
| HL | 2.13 ± 0.13 (2.00-2.25) | | 2.34 ± 0.17 (2.13-2.50) | | 1.85 ± 0.25 (1.30-2.00) | | 1.98 ± 0.20 (1.60-2.20) | |
| LE | 1.25 ± 0.05 (1.20-1.30) | | 1.31 ± 0.12 (1.20-1.50) | | 1.39 ± 0.09 (1.30-1.50) | | 1.45 ± 0.16 (1.20-1.70) | |
| ID | 1.48 ± 0.07 (1.44-1.56) | | 1.55 ± 0.11 (1.32-1.74) | | 2.79 ± 0.17 (2.50-3.00) | | 2.61 ± 0.34 (1.80-1.90) | |
| I | 0.59 ± 0.03 (0.57-0.61) | | 0.65 ± 0.06 (0.57-0.76) | | 1.85 ± 0.10 (1.70-2.00) | | 1.67 ± 0.14 (1.50-1.80) | |
| II | 0. 76 (0.76) | | 1.02 ± 0.12 (0.91-1.22) | | 2.67 ± 0.16 (2.50-2.90) | | 2.40 ± 0.33 (2.00-2.90) | |
| III | 1.20 ± 0.03 (1.18-1.22) | | 1.14 ± 0.10 (1.03-1.33) | | 3.57 ± 0.64 (3.50-3.90) | | 3.00 ± 0.28 (2.50-3.30) | |
| IV | 0.70 ± 0.16 (1.18-1.41) | | 1.39 ± 0.17 (1.25-1.63) | | 3.68 ± 0.16 (3.50-3.90) | | 3.42 ± 0.13 (3.20-3.50) | |
| V | 1.42 ± 0.13 (1.33-1.52) | | 1.55 ± 0.27 (1.25-1.79) | | 4.00 ± 0.24 (3.80-4.40) | | 3.75 ± 0.19 (3.60-4.00) | |
| PW | 7.96 ± 0.47 (7.63-8.50) | | 8.15 ± 0.63 (7.38-9.25) | | 6.36 ± 0.39 (5.90-7.00) | | 6.03 ± 0.32 (5.50-6.40) | |
| PL | 2.38 ± 0.25 (2.13-2.63) | | 2.35 ± 0.28 (2.38- 3.06) | | 2.53 ± 0.20 (2.20-2.80) | | 2.39 ± 0.24 (2.00-2.80) | |
| SW | 3.74 ± 0.22 (3.57-3.98) | | 4.39 ± 0.49 (3.49-4.98) | | 5.45 ± 0.34 (5.00-6.00) | | 5.53 ± 0.28 (5.10-5.90) | |
| SL | 4.17 ± 0.19 (4.00-4.38) | | 4.68 ± 0.43 (3.88-5.13) | | 3.70 ± 0.24 (3.40-4.00) | | 3.85 ± 0.81 (3.30-5.80) | |

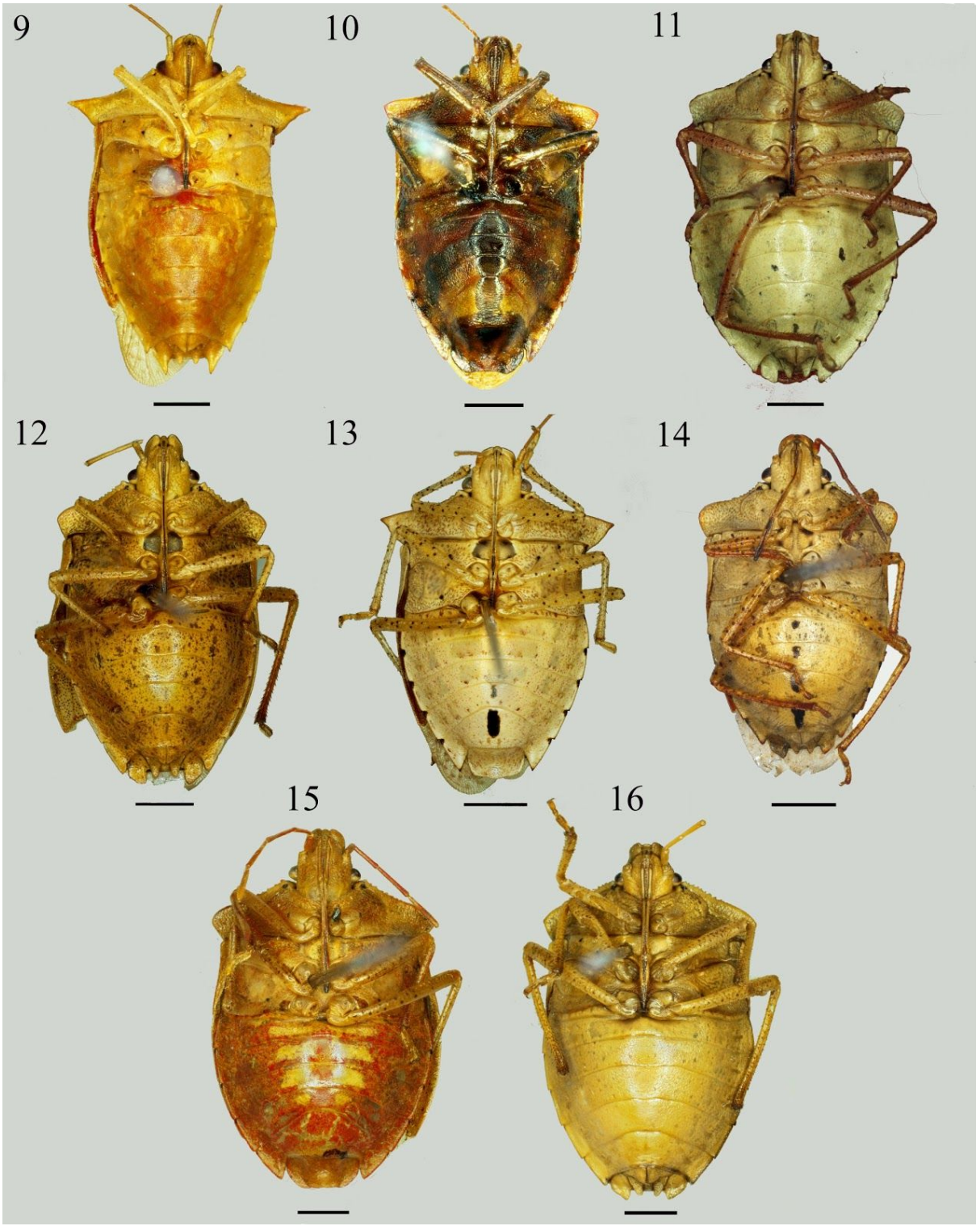
**Table 1:** Measurements (mean ± standard deviation; minimum–maximum values) given in millimeters of the following 15 morphometric parameters: total body length (BL), abdominal width (AW), maximum width of head (HW), length of head (HL), length of head before eyes (LE), interocular distance (ID), length of antennomeres: I (I), II (II), III (III), IV (IV), V (V), maximum pronotal width (PW), pronotal length (PL), and maximum scutellar width (SW). scutellar length (SL).

| | *E. t. tristigmus* | | *E. t. luridus* | | *E. inflatus* | | *E. latimarginatus* | |
|---|---|---|---|---|---|---|---|---|
| | Male (n=6) | Female (n=3) | Male (n1=) | Female (n=3) | Male (n=8) | Female (n=6) | Male (n=8) | Female (n=6) |
| BL | 11.02 ± 1.05 (9.38-12.50) | | 11.31 ± 0.83 (10.63-12.50) | | 13.05 ± 0.63 (12.38-14.00) | | 13.29 ± 0.37 (12.50-13,63) | |
| AW | 6.84 ± 1.37 (5.25-8.88) | | 6.53 ± 0.48 (6.38-7.25) | | 8.38 ± 0.46 (7.50-8.88) | | 8.21 ± 0.26 (7.63-8.50) | |
| HW | 2.32 ± 0.14 (2.13-2.50) | | 2.41 ± 0.16 (2.25-2.63) | | 2.75 ± 0.12 (2.50-2.94) | | 2.71 ± 0.06 (2.63-2.75) | |
| HL | 2.18 ± 0.13 (2.00-.2.38) | | 2.22 ± 0.19 (2.13-2.50) | | 2.45 ± 0.16 (2.13-2.75) | | 2.52 ± 0.14 (2.25-2.75) | |
| HLBE | 1.22 ± 0.13 (1.00-1.40) | | 1.25 ± 0.10 (1.25-1.38) | | 1.53 ± 0.18 (1.38-2.00) | | 1.59 ± 0.09 (1.38-1.75) | |
| ID | 1.42 ± 0.09 (1.26-.1.50) | | 1.35 ± 0.17 (1.20-1.50) | | 1.87 ± 0.11 (1.600-2.00) | | 1.87 ± 0.15 (1.40-2.00) | |
| I | 0.68 ± 0.35 (0.61-0.68) | | 0. 60 (0.60) | | 0.73 ± 0.06 (0.63-0.78) | | 0.39 ± 0.41 (0.7-0.9) | |
| II | 0.49 ± 0.48 (0.80-0.91) | | 0.34 ± 0.39 (0.60-0.80) | | 1.18 ± 0.12 (1.05-1.29) | | 0.55 ± 0.58 (0.9-1.3) | |
| III | 0.60 ± 0.58 (1.25-0.95) | | 0.90 (0.90) | | 1.48 ± 0.14 (1.65-1.50) | | 0.57 ± 0.68 (1.20-1.4) | |
| IV | 0.61 ± 0.74 (1.48-1.29) | | 1.01 (1.01) | | 1.52 ± 0.13 (1.36-1.65) | | 0.29 ± 0.57 (1.3-1.40) | |
| V | 0.34 ± 0.75 (1.52-1.56) | | 1.40 (1.40) | | 1.68 (1.68) | | 0.22 ± 0.57 (1.50-1.62) | |
| PW | 7.78 ± 0.81 (6.50-8.88) | | 7.09 ± 0.52 (6.88-7.88) | | 8.30 ± 0.44 (7.63-9.13) | | 8.50 ± 0.40 (7.63-9.00) | |
| PL | 2.74 ± 0.35 (2.38-3.38) | | 2.81 ± 0.13 (2.60-2.90) | | 3.41 ± 0.24 (3.13-3.75) | | 3.55 ± 0.25 (3.13-4.13) | |
| SW | 4.18 ± 0.43 (3.53-4.73) | | 4.23 ± 0.12 (4.2-4.4) | | 5.26 ± 0.21 (4.81-5.48) | | 5.25 ± 0.27 (4.57-5.64) | |
| SL | 4.01 ± 0.36 (3.38-4.50) | | 4.09 ± 0.21 (4.00-4.38) | | 4.94 ± 0.32 (4.25-5.38) | | 5.16 ± 0.21 (4.75-5.50) | |

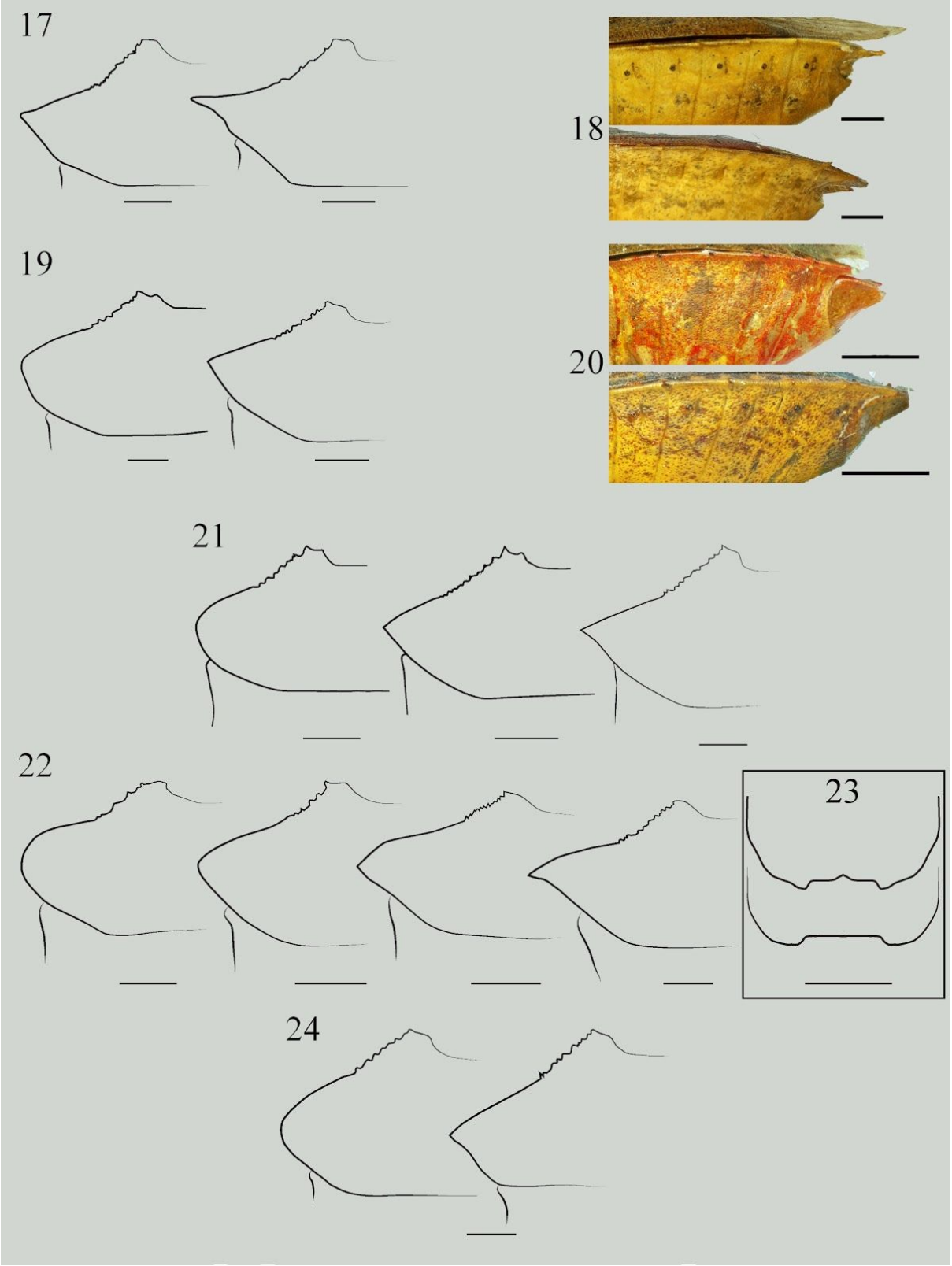
**Table 2:** Measurements (mean ± standard deviation; minimum–maximum values) given in millimeters of the following 15 morphometric parameters: total body length (BL), abdominal width (AW), maximum width of head (HW), length of head (HL), length of head before eyes (LE), interocular distance (ID), length of antennomeres: I (I), II (II), III (III), IV (IV), V (V), maximum pronotal width (PW), pronotal length (PL), and maximum scutellar width (SW). scutellar length (SL).



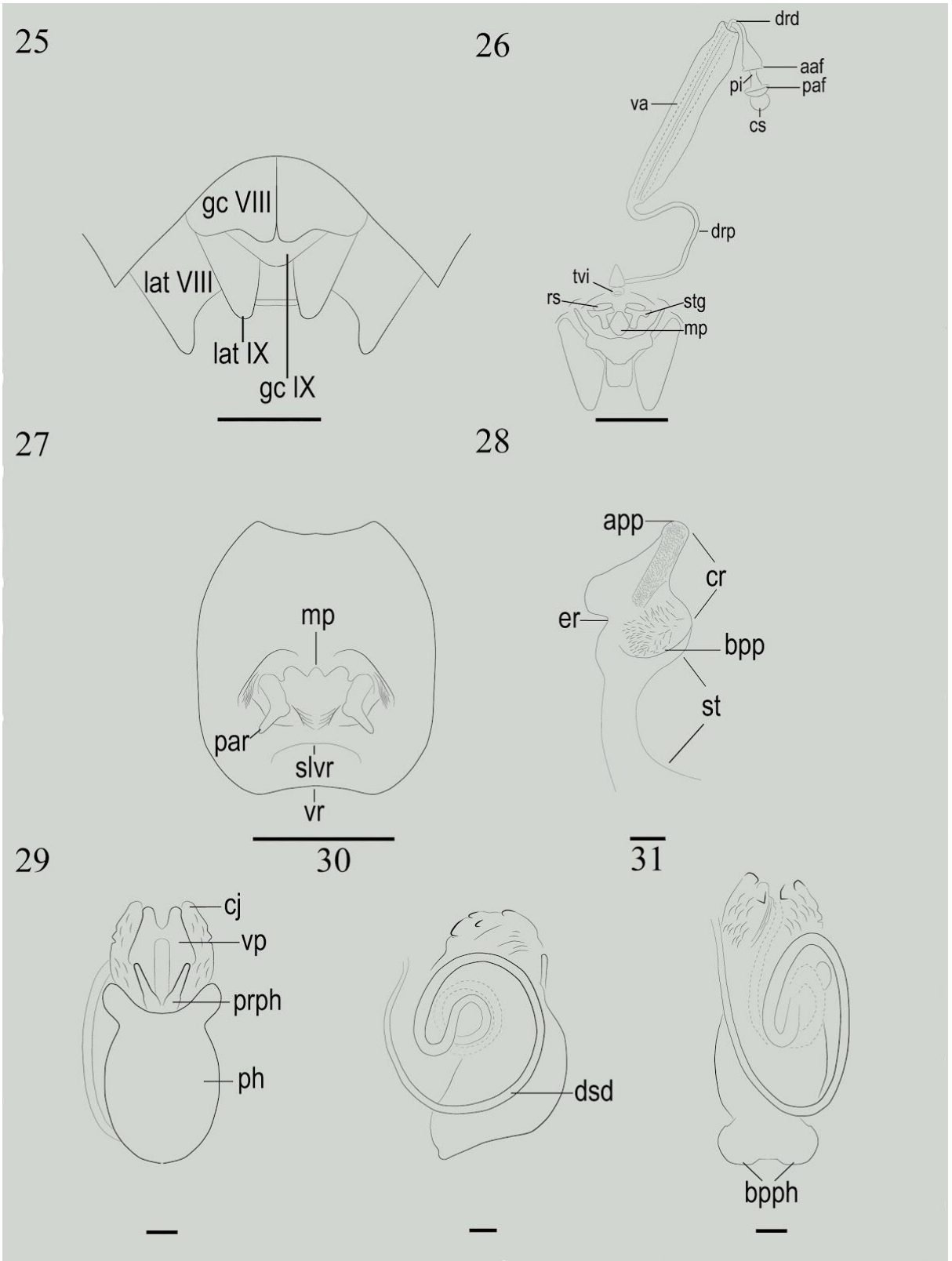

**Figures 1-8: Dorsal view:** 1. *Euschistus ictericus;* 2. *E. variolarius;* 3. *E. servus servus;* 4. *E. servus euschistoides*; 5. *E. tristigmus tristigmus*; 6.. *E. tristigmus luridus*; 7. *E. inflatus*; 8. *E. latimarginatus.* Scale Bars: 1mm.




**Figures 9–16: Ventral view:** 9. *Euschistus ictericus;* 10. *E. variolarius;* 11. *E. servus servus;* 12. *E. servus euschistoides*; 13. *E. tristigmus tristigmus*; 14. *E. tristigmus luridus*; 15. *E. inflatus*; 16. *E. latimarginatus.* Scale Bars: 1mm.



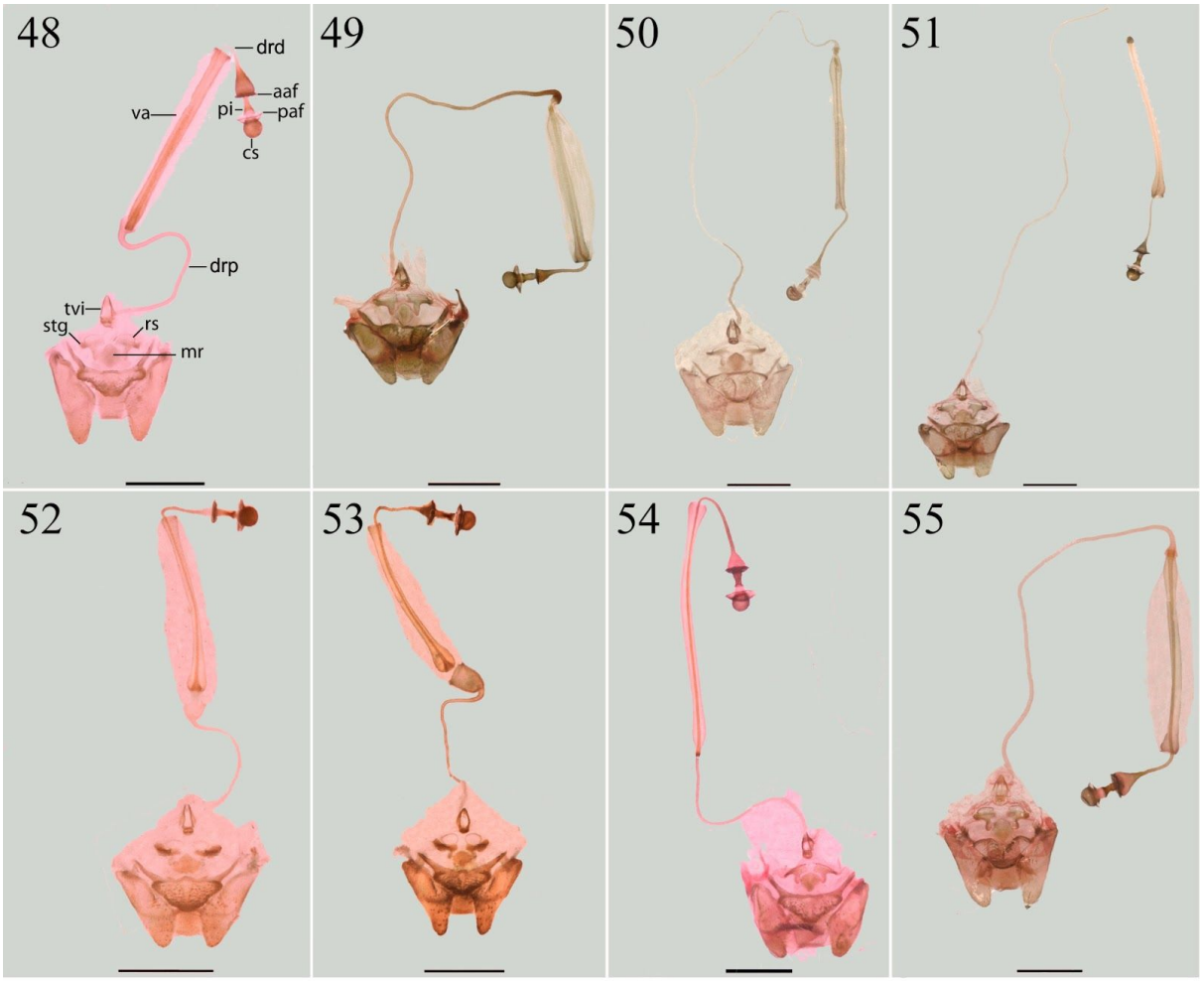

**Figures 17–24: Variations in humeral angles; 18-20: Variation in the colour of the spiracles; 23: Variation in the margin of ventral rim of pygophore:** 17. *Euschistus ictericus;* 18. *Euschistus ictericus;* 19. *E. variolarius;* 20. *E. inflatus* 21. *E. servus.* 22-23 *E. tristigmus*. 24. *E. latimarginatus.* Scale Bars: 1mm.



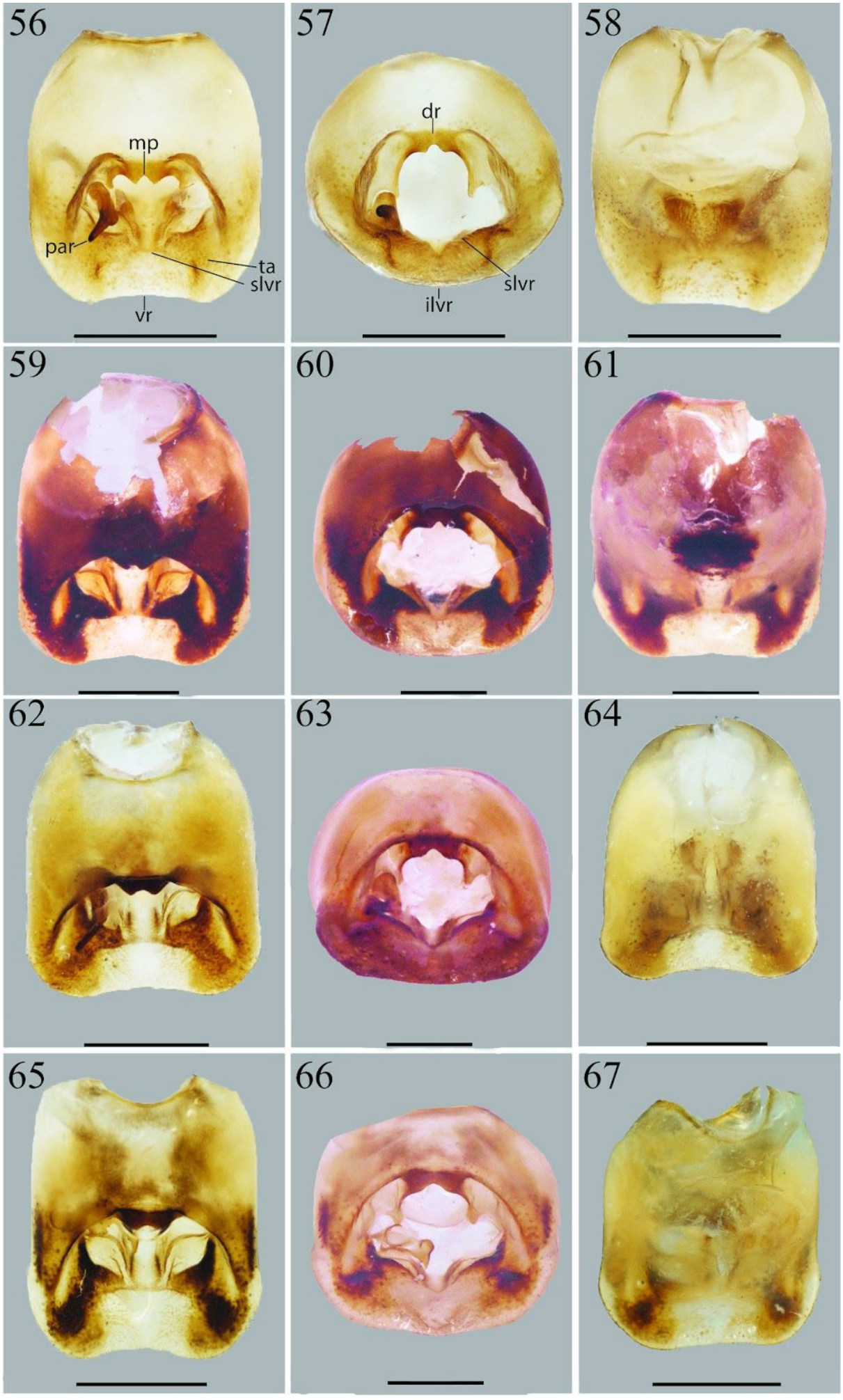

**Figures 25–31: Illustrations of the internal and external genitalia of *E. ictericus*.** 25. Genital Plates in postero ventral view; 26 Internal genitalia; 27. Pygophore in dorsal view; 28. Paramere; 29-30-31. Phallus in dorsal, lateral and ventral view respectively. Abbreviations: Genital plates: gcVIII= gonocoxites VIII; gcIX= gonocoxites IX laVIII= laterotergites VIII; LaIX= laterotergites IX; Internal genitalia: aaf= anterior annular flange; cs= capsula seminalis; drd= ductu receptaculi distal;

mr= medial region; va= vesicular area; paf= posterior annular flange; pi= pars intermedialis; ppdr= ductus receptaculi proximal; rs= ring sclerites; stg= secondary thickenings of gonapophyses IX; tvi= thickening of vaginal intima. Pygophore: mp = median projection; par = paramere; spvr = superyor layer of ventral rim; vr= ventral rim. Paramere: app = apical process of paramere; cr = crown; bpp= basal process of paramere; st= stem. Phallus: bpph= Basal process of phalloteca; cj= conjunctiva; dsd= ductus seminis distalis; prph= Process of phalloteca ph= Phalloteca; vp= vesica process. Scale bars: 25-27 1mm; 28–31: 0.1 mm.


**Figures 32–47: Genital plates.** In posterior view: (32-34-36-38-40-42-44-46 32-33); In postero ventral view: (33-35-37-39-41-43-45-47). *Euschistus ictericus;* 34-35 *variolarius;* 36-37. *E. servus servus*; 38-39. *E. servus euschistoides;* 40-41. *E. tristigmus tristigmus*; 42-43. *E. tristigmus luridus;* 44-45. *E. inflatus;* 46-47. *E. latimarginatus*. Abbreviations: gcVIII= gonocoxites VIII; gcIX= gonocoxites IX laVIII= laterotergites VIII; LaIX= laterotergites IX; Scale bars: 1mm.



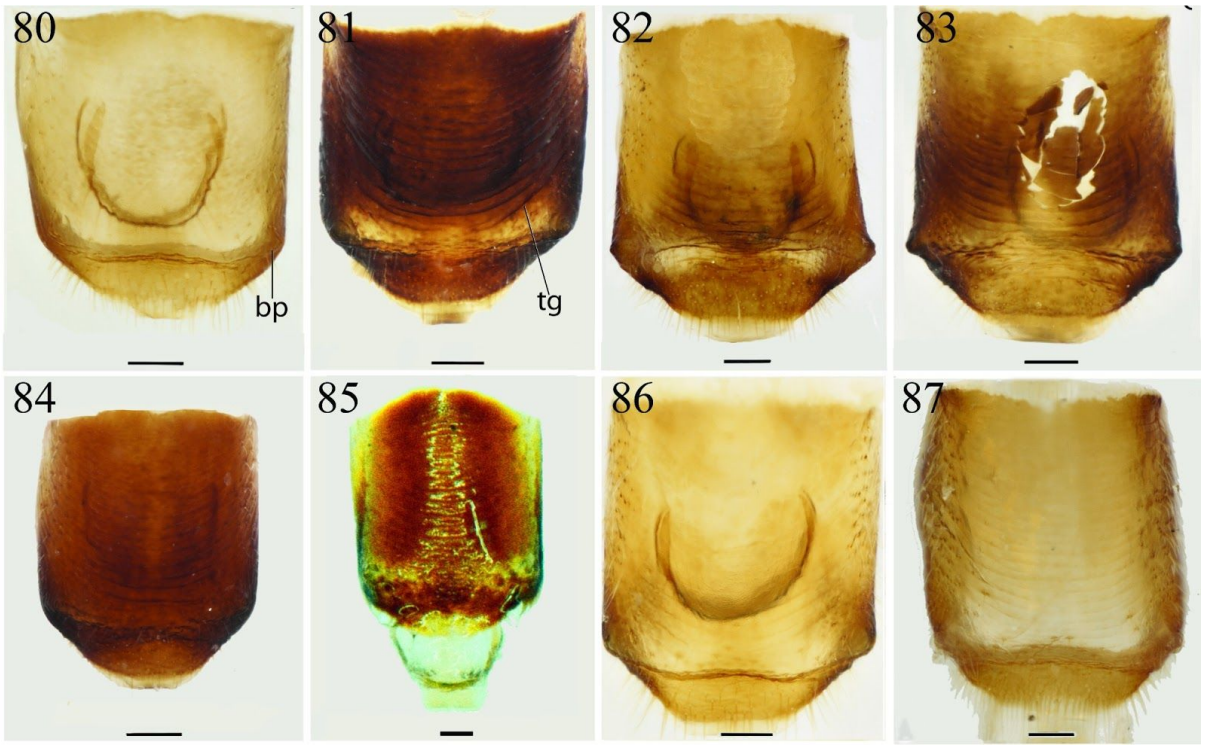

**Figures 48–55: Internal female genitalia.** 48. *Euschistus ictericus;* 49. *E. variolarius;* 50. *E. servus servus;* 51. *E. servus euschistoides*; 52. *E. tristigmus tristigmus*; 53. *E. tristigmus luridus*; 54. *E. inflatus*; 55. *E. latimarginatus.* Abbreviations: aaf= anterior annular flange; cs= capsula seminalis; drd= ductus receptaculi distal; mr= medial region; va= vesicular area; paf= posterior annular flange; pi= pars intermedialis; ppdr= ductu receptaculi proximal; rs= ring sclerites; stg= secondary thickenings of gonapophyse IXs; tvi= thickening of vaginal intima. Scale bars: 1mm


56
mp
par
ta
slvr
vr
57
dr
slvr
ilvr
58
59
60
61
62
63
64
65
66
67


68
69
70
71
72
73
74
75
76
77
78
79

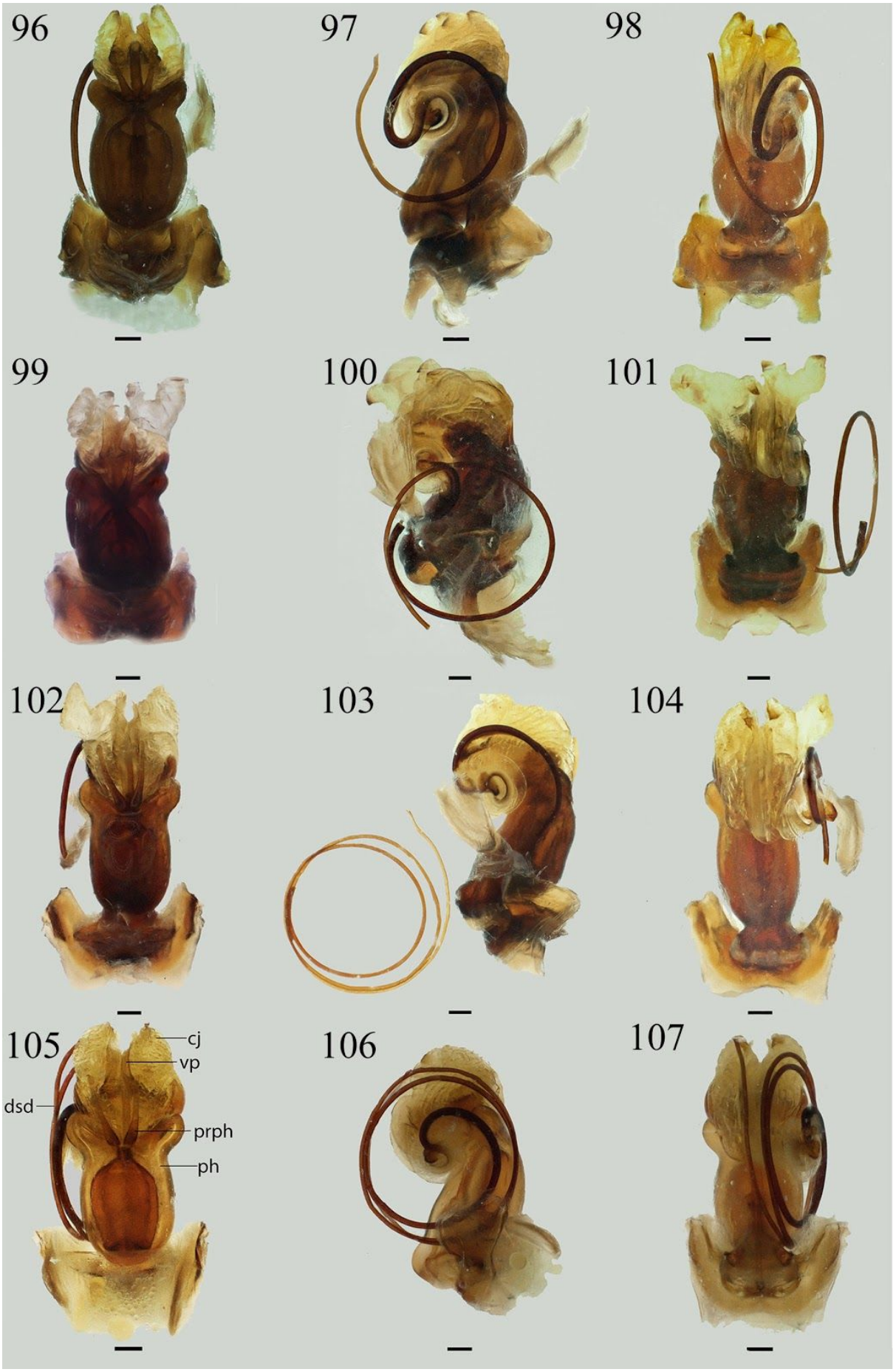
**Figures 56–67: Pygophore:** In Dorsal view (56, 59, 62, 65; in posterior view (69, 72, 75, 78); in ventral view (70, 73, 76, 79). 56–58 *Euschistus ictericus*; 59–61 *E. variolarius;* 62–64 *E.* (*E.*) *servus servus*; *E. servus euschistoides*; Abbreviations: mp = medial projection; par = paramere; slvr = superior layer of ventral rim; ta = tumescent area; dr = dorsal rim; vr= inferior layer of ventral rim; Scale bars: 1mm.

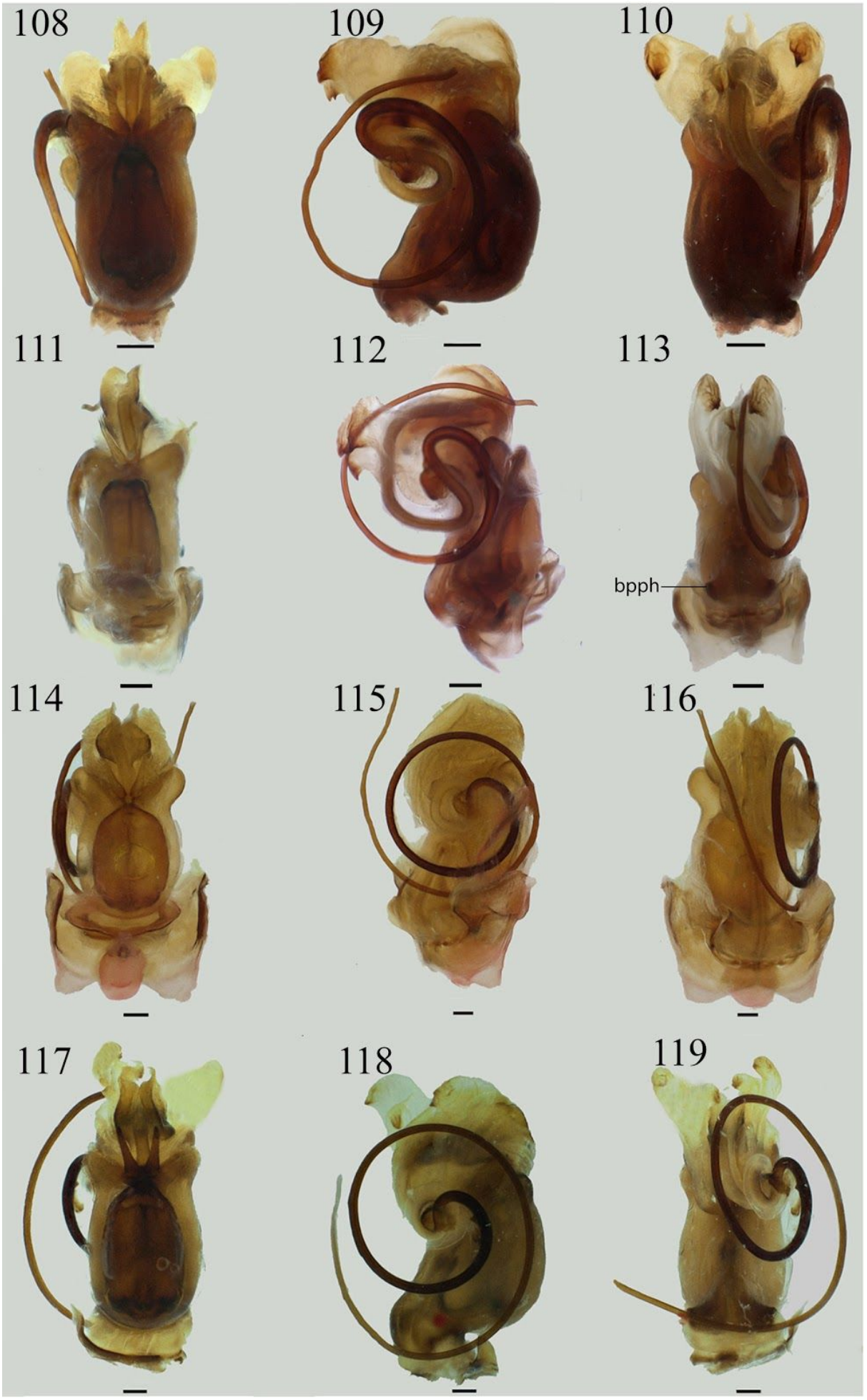
**Figures 68–79: Pygophore:** In Dorsal view (68, 71, 74, 77); in posterior view (69, 72, 75, 78); in ventral view (70, 73, 76, 79). *E.* (*E.*) 68–70 *tristigmus tristigmus*; 71–73 *E. tristigmus luridus*; 74–76 *E. inflatus*; 65–67 *E. latimarginatus*.




**Figures 80–87: Tenth segment:** In dorsal view: 80. *Euschistus ictericus;* 81. *E. variolarius*; 82. *E. servus servus;* 83. *E. servus euschistoides;* 84. *E. tristigmus tristigmus;* 85. *E. tristigmus luridus*; 86. *E. inflatus;* 87. *E. latimarginatus.* Abbreviations: bp= bumps; tg= transversal grooves Scale bars: 0.1 mm.


**Figures 88–95: Paramere**. In ventral view: 88. *Euschistus ictericus*; 89. *E. variolarius*; 90. *E. servus servus*; 91. *E. servus euschistoides*; 92. *E. tristigmus tristigmus*; 93. *E. tristigmus luridus;* 94. *E. inflatus*; 95 *E. latimarginatus.* Abbreviations: app= apical process of paramere; bpp= basal process of paramere; cr= crown; st= stem. Scale Bars: 0.1 mm.


96
97
98
99
100
101
102
103
104
105
cj
vp
dsd
prph
ph
106
107


108
109
110
111
112
113
bpph
114
115
116
117
118
119

**Figures 96–107: Phallus:** In Dorsal view (96, 99, 102, 105); in posterior view (97, 100, 103, 106); in ventral view (98, 101, 104, 107). 96–98 *Euschistus ictericus;* 99–101. *E. variolarius;*. 102–104 *E. servus servus;* 105–107 *E. servus euschistoides;* Abbreviations: cj= conjunctiva; dsd= ductus seminis distalis; prph= Process of phalloteca ph= Phalloteca; vp= vesica process. Scale Bars: 0.1 mm.

**Figures 108–119: Phallus:** In Dorsal view (108, 111, 114, 117); in posterior view (109, 112, 115, 118); in ventral view (110, 113, 116, 119). 108–110. *E. tristigmus tristigmus*;111–113 *E. tristigmus luridus;* 114–116 *E. inflatus;* 117–119 *E. latimarginatus.* Abbreviations: bpph= Basal process of phalloteca; Scale Bars: 0.1 mm.

# CONCLUSÕES

Nossos resultados indicam que os integrantes desse agrupamento proposto por Stål compartilham diversas características de genitália interna e externa, masculina e feminina, essa última, historicamente negligenciada dentro do gênero. As duas espécies que incluímos, mostraram as mesmas particularidades, principalmente em estruturas genitais. Nossas análises evidenciaram que a genitália feminina pode ser bastante informativa taxonomicamente, e se incluída em futuros trabalhos filogenéticos, pode vir a agregar maior fonte de conhecimento para o grupo. Essas similaridades de estruturas de genitália, somadas à morfologia geral e localidade geográfica, nos permitiu propor o grupo ictericus para abrigar as cinco espécies: *Euschistus ictericus, E. variolarius, E. servus, E. inflatus* e *E. latimarginatus.*

As duas subespécies analisadas mostraram poucas variações em genitália masculina e feminina, e suas regiões de simpatria levou-nos a tomar a decisão taxonômica de sinonimizar *E. servus euschistoides* com *E. servus servus* e *E. tristigmus luridus* com *E. tristigmus tristigmus.*

Neste trabalho fornecemos ilustrações de hábitos dorsais e ventrais, bem como ilustrações de genitália masculina e feminina e suas estruturas internas. Evidenciamos variações intraespecíficas nos ângulos umerais e pigóforo. Essas informações são valiosas quando se trata de um subgênero pouco explorado, e contendo espécies de importância econômica. A redescrição destas espécies e novas diagnoses proporcionará um aumento na compreensão e identificação dos táxons pertencentes ao grupo ictericus.

# ANEXO I
# NORMAS PARA PUBLICAÇÃO
# THE CANADIAN ENTOMOLOGIST

Disponível em:
https://www.cambridge.org/core/journals/canadian-entomologist/information/instructions-contributors