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SYSTEMATICS OF *ISCHIOLEPTA* LIOY (DIPTERA: SPHAEROCERIDAE)

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Systematics of *Ischiolepta* Lioy (Diptera: Sphaeroceridae)

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ABSTRACT The nominal species of the genus *Ischiolepta* Lioy were studied, and their phylogenetic relationships were analyzed. Nineteen species of *Ischiolepta*, including three new species, are described and illustrated: *I. crenata* (Meigen), *I. denticulata* (Meigen), *I. draskovitsae* Roháček and Papp, *I. flava* (Vanschuytbroeck), *I. horrida* Papp, *I. intermedia* Han and Kim, sp. n., *I. loebli* Roháček and Papp, *I. longispina* Papp, *I. micropyga* (Duda), *I. nitida* (Duda), *I. oedopoda* Papp, *I. orientalis* (de Meijere), *I. pansa* Han and Kim, sp. n., *I. pusilla* (Fallén), *I. scabra* (Spuler), *I. scabricula* (Haliday), *I. stuarti* Han and Kim, sp. n., *I. vanschuytbroeckii* Papp, and *I. vaporariorum* (Haliday). A key to the species and the inferred phylogeny of *Ischiolepta* also are presented.

KEY WORDS Insecta, *Ischiolepta*, systematics, taxonomy

THE SPECIES OF *Ischiolepta* Lioy are relatively little-known flies of the acalyptrate family Sphaeroceridae. Like other sphaerocerids, the species of *Ischiolepta* are saprophagous in their larval stages and are commonly found in the excrement of various animals and in other decaying organic matter. Although found primarily in the Holarctic Region, they are known from all major zoogeographic regions.

Lioy (1864) erected *Ischiolepta* as a monotypic genus for *Borborus denticulatus* Meigen. Hendel (1921) recognized the genus *Allosphaerocera*, in which *I. pusilla* (Fallén), *I. crenata* (Meigen) (as *Sphaerocera coronata*), *I. denticulata* (Meigen) and *Lotobia pallidiventris* (Meigen) (as *L. hyalipennis*) were included. However, Spuler (1924) treated *Ischiolepta* as a subgenus of *Sphaerocera* Latreille. Richards (1930) further recognized the *Sphaerocera pusilla* group (equivalent to *Ischiolepta*) within the subgenus *Lotobia* of *Sphaerocera*. Duda (1938) restricted the subgenus *Lotobia* to *S. pallidiventris* Meigen without recognizing other subgenera of *Sphaerocera* (s.l.). As numerous African species of *Sphaerocera* (s.l.) were discovered (e.g., Vanschuytbroeck 1942, 1943, 1948, 1951, 1959a, b), Richards (1965b) recognized four distinct subgenera including *Lotobia* and *Ischiolepta*, which had been treated together as the subgenus *Lotobia* in his earlier works (Richards 1930, 1965a). Kim (1972b) recognized eight distinct genera in the subfamily Sphaerocerinae (= *Sphaerocera* s.l.): *Sphaerocera* Latreille, *Afromyia* Kim, *Neosphaerocera* Kim, *Mesosphaerocera* Kim, *Parasphaerocera* Spuler, *Ischiolepta* Lioy, *Lotobia* Lioy, and *Safaria* Richards. He grouped *Ischiolepta* with *Lotobia* and *Safaria* in a suprageneric group, the *Lotobia* group, which he considered the earliest phyletic branch of the Sphaerocerinae. Recently, an interesting array of new Palearctic *Ischiolepta*

has been described by Papp (1972, 1973b, 1978) and Roháček & Papp (1984).

In this paper, a taxonomic study of *Ischiolepta* Lioy is presented, and its phylogenetic relationships are discussed. Illustrated descriptions are provided for a total of 19 species, including three new species: *I. intermedia* Han and Kim, *I. pansa* Han and Kim, and *I. stuarti* Han and Kim. Type specimens of nominal species have been examined, and lectotypes have been designated for *I. crenata* (Meigen), *I. denticulata* (Meigen), *I. micropyga* (Duda), *I. nitida* (Duda), *I. pusilla* (Fallén), *I. scabricula* (Haliday), and *I. vaporariorum* (Haliday). A key to the species of *Ischiolepta* also is presented. Phylogenetic relationships of the inclusive species were inferred by a cladistic method.

Materials and Methods

Our study is based on approximately 800 pinned specimens, including 35 primary and secondary types, borrowed from the following museums and institutions: American Museum of Natural History, New York (AMNH), P. Wygodzinsky; R. M. Bohart Entomological Museum, University of California, Davis (UCD), A. T. McClay; British Museum (Natural History), London (BMNH), B. R. Pitkin; California Academy of Sciences, San Francisco (CAS), P. H. Arnaud, Jr.; Canadian National Collection, Ottawa (CNC), H. J. Teskey; Hope Entomological Collections, Oxford, England (UMO), M. J. Scoble; Hungarian Natural History Museum, Budapest (HNHM), L. Papp; Insect Collection, University of Arizona, Tucson (UAT), F. G. Werner; Institut für Spezielle Zoologie und Zoologische Museum der Humboldt Universität, Berlin (ZMHU), H. Schumann; Institut Royal des Sciences Naturelles de Belgique, Brussels (IRSN), P. Grootaert; Instituut voor Taxonomisch Zoölogie, Amsterdam, Nether-

lands (ITZA), B. Brugge; M. T. James Entomological Museum, Washington State University, Pullman (WSU), R. S. Zack; Musée Royal de l'Afrique Centrale, Tervuren (MRAC), E. De Coninck; Muséum d'Histoire Naturelle, Genève, Switzerland (MHNG); Museum National d'Histoire Naturelle, Paris (MNHN), L. Matile; Museum of Comparative Zoology, Harvard University, Cambridge, Mass. (MCZ), J. F. Lawrence; Museum of Victoria, Australia (MVA), A. Neboiss; National Collection of Ireland, Dublin (NCID), J. P. O'Conner; Naturhistoriska Riksmuseet, Stockholm, Sweden (NRS), P. I. Persson; Naturhistorisches Museum, Vienna, Austria (NMW), R. Contreras-Lichtenberg; Ohio State University, Columbus (OSUC), C. A. Triplehorn; Snow Museum of Entomology, University of Kansas, Lawrence (UKAL), G. W. Byers; Staatliches Museum für Naturkunde, Stuttgart, Federal Republic of Germany (SMNS), H. P. Tschorsnig; Swedish Museum of Natural History, Stockholm, Sweden (SMNH), Karl-Johan Hedqvist; Universitets Zoologiska Institut, Uppsala, Sweden (UZIU), L. Hedström; National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM), W. W. Wirth and A. L. Norrbom; University of California, Riverside (UCR), S. I. Frommer; University of Guelph, Ontario (GUE), S. A. Marshall; University of Texas, Austin (UTA), M. R. Wheeler; Zoological Institute, Leningrad, USSR (ZIL), E. P. Nartshuk; Zoological Institute, University of Lund, Sweden (ZIUL), R. Danielsson; Zoologiska Museum, Helsinki, Denmark (ZMH), W. Hackman. In addition, the acronym SMC represents the Silesian Museum, Opava, Czechoslovakia; and LEOU represents the Laboratory of Entomology, Obihiro University, Japan.

All characters examined were recorded on the "Analysis of Taxonomic Characters" forms devised by Kim (1968), and these data were entered on a personal computer for taxonomic analyses, including description and character matrices, using the Lotus 1-2-3 spreadsheet program. In the species descriptions, those characters that are common to all species of *Ischiolepta* are not repeated. The morphological interpretations and terminology used in this paper follow McAlpine (1981) and Marshall & Richards (1987). For those characters not treated by those authors, we follow Kim & Cook (1966) (e.g., epistoma, supra-, infra-, and subgena).

For cladistic analysis, all characters recorded on the "Analysis of Taxonomic Characters" form were surveyed, and only those showing definite interspecific variation with little intraspecific variation were selected. Character polarity was determined by out-group analysis in most cases. Although about 40 characters were initially selected, more than half were excluded after determining their polarities because the apomorphic character states occurred in only one species.

To generate a preliminary cladogram, Mix, Dollop, and Factor programs of PHYLIP (Phylogeny Inference Package, version 3.0 [Felsenstein 1987])

was used. Because the character set contained multistate characters, the Factor program was used to convert them to binary characters. The converted data set was run on two programs, Mix (Mixed method parsimony) and Dollop (dollo and polymorphism parsimony). Mix generated 29 trees and Dollop generated 40 trees, many of which presented conflicting hypotheses. This may be partly because of the conversion of multistate characters to binary data. After all of the trees were examined by matching characters, the most parsimonious tree was selected (Wiley 1981, Felsenstein 1984). When unable to establish dichotomy owing to the lack of recognized synapomorphy, we used trichotomy.

Characters of Taxonomic Importance. Although *Ischiolepta* are generally dull flies without conspicuous color, their color patterns sometimes provide important characters. All the character states related to color pattern are defined by comparison with other parts of the body (dark versus light). For example, the brownish yellow clypeus and epistoma contrasting well with the dark frons is a useful character for distinguishing *I. orientalis* and *I. draskovitsae* from other species. Light leg color contrasting with dark thoracic pleura provides the primary character to differentiate some allied species. However, these characters might cause confusion when one attempts to identify teneral adults.

The pollinosity pattern of the thoracic dorsum provides a quick diagnostic character for separating some species, although it is not always reliable, especially for specimens preserved in alcohol.

Head shape is generally consistent in those *Ischiolepta* species having a large pentagonal epistoma which occupies most of the face (Fig. 1, 5-7). The most useful taxonomic characters that we found at the specific level are in the shape and size of the outer vertical setae, inner vertical setae, and fronto-orbital setae. The overall shape of the head in frontal and lateral views also provides a supplemental means of identification.

Structural details of the thorax also are generally similar in most species (Fig. 2, 8, 9). The size of the tubercles on the scutum, together with leg color and thickness, distinguish the *pusilla* group from the *denticulata* group (see Inferred Phylogeny section). The density of acrostichal setae on the presutural area of the scutum also is a good diagnostic character. The shape of the scutellum and marginal scutellar tubercles provide taxonomically important characters for distinguishing Afrotropical *Ischiolepta* species, but the number of marginal scutellar tubercles often varies infraspecifically. Although the density of katepisternal hairs varies among species, the differences are so subtle that this character is reliable only in distinguishing the male of *I. oedopoda*, which has very dense hairing.

The structure of the legs and wings provide only minor taxonomic characters. In some species, the hind femora are swollen and uniquely shaped. The color and shape of the wings and halteres are con-

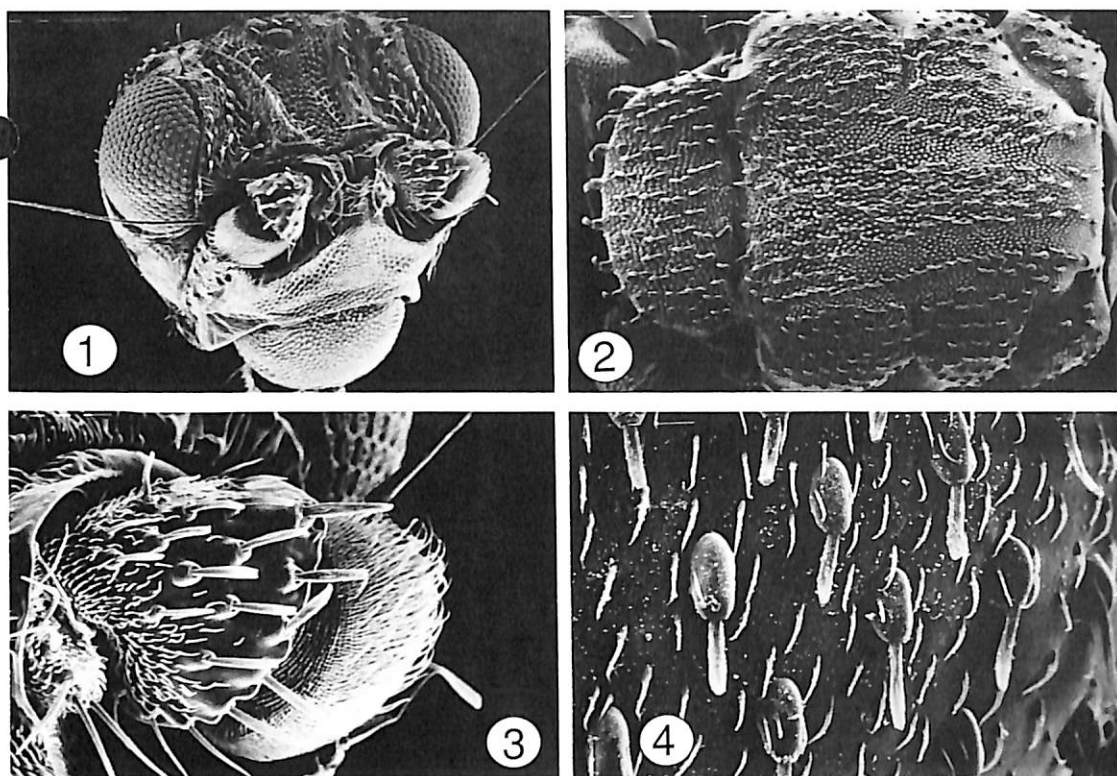


Fig. 1-4. *Ischiolepta pusilla*. (1) Male: head, fronto-lateral view. (2) Male: thorax, dorsal view. (3) Antenna, frontal view. (4) Setae on scutellum.

istent within the genus except in *I. crenata*, which has black halteres.

The shape and size of preabdominal tergites and sternites, although somewhat variable, are useful for distinguishing species. The shapes of abdominal tergite 5 and sternite 5 provide good taxonomic characters for resolving cladistic relationships among *I. denticulata* and its allied species.

The male postabdomen provides the most important array of taxonomic characters; all the species recognized in this study can be identified with confidence by genitalic characters. Genitalic characters are distinct, even between seemingly very closely related species. The shapes of the cerci, surstyli, distiphallus, and parameres are useful taxonomic characters; the distiphallus is the most differentiated interspecifically among these structures. Although genitalia provide an indispensable means of species identification, they do not provide much phylogenetic information because most of these highly specialized structures appear to be autapomorphic; i.e., they occur only in single species.

The female postabdomen provides a limited number of characters. It is long and telescoped, with the sclerites highly reduced. Although the pattern of reduction of the sclerites is generally

similar, it is nevertheless useful for distinguishing a few species (cf. *I. loebli*).

Genus *Ischiolepta* Lioy

Ischiolepta Lioy 1864: 1112 (type-species: *Borborus denticulata* Meigen, by monotypy); Kim 1972b: 441-443; Papp 1972: 469-472; 1973a: 358; 1973b: 370-372; 1978: 392-394; 1984: 70-72; Hackman 1977: 399; 1980: 147; Roháček 1978: 244; Roháček & Papp 1984: 469-479; Pitkin 1988: 33-34.

Allosphaerocera Hendel (*partim*) 1921: 53-56.

Sphaerocera (*Allosphaerocera*); Spuler (*partim*) 1924: 66-71.

Sphaerocera (*Lotobia*); Richards (*partim*) 1930: 264, 318-319; 1965a: 718-719; Vanschuytbroeck (*partim*) 1951: 3-4; 1959b: 39-40.

Sphaerocera (*Ischiolepta*); Richards 1965b: 223-242; 1980: 625.

Ischiogaster; Richards 1930: 264 (misspelling).

Diagnosis. The 19 known species of *Ischiolepta* can be easily distinguished from the rest of the Sphaerocerinae by the following combination of characters: Epistoma enlarged to form pentagonal plate occupying most of face (Fig. 1); scutellum

with 6–10 strong marginal tubercles (Fig. 163); thoracic dorsum covered by numerous short, blunt, tuberculated setae; acrostichal setae usually in 4 irregular rows; row of dorsocentral setae well-delimited from acrostichal setae by bare area between them (Fig. 9).

Description. Generally brown to black flies; 1.5–3.65 mm long; bearing numerous short blunt setae on tubercles (Fig. 4). **Head.** About as long as its height; frons as wide as long; frontal vitta flat, somewhat concave, largely granulated; parafrontal with numerous small upcurved setae mainly on orbital area (Fig. 5); outer vertical seta, ocellar seta, and 2 pairs of fronto-orbital setae usually well developed (Fig. 7), at least twice as long as most other setae (except in *scabricula*, with uniformly sized setae) (Fig. 135 and 136); inner vertical seta usually short, inclined inward, reaching less than halfway to ocellar triangle except in *I. draskovitsae* and *I. orientalis*; postocular setae in irregular rows, denser on upper area; facial ridge distinct, triangular with numerous setae; vibrissa thick, flat, about as long as pedicel; 2–5 subvibrissal setae about subequal to vibrissa; gena usually bare, distinctly subdivided into 3 regions (supra-, infra-, and subgena) (Fig. 6); clypeus large; epistoma large, pentagonal or triangular, marginated ventrally; antennal groove deep with edge sharply carinate; facial carina narrow, connected with epistoma; antennae small, strongly divergent; scape short, flattened with 3–5 hairlike setae; pedicel triangular with dense flattened setae; first flagellomere globular to spherical, densely pubescent (Fig. 3); arista 2.5–4.5 times as long as 3 basal segments, bare, shiny; mouthparts usually concealed in deep oral cavity formed by subgena and clypeus; eyes circular to elliptic with longest diameter subequal to genal height (except in *I. scabricula* with quite reduced eye). **Thorax.** Color brown to black; covered with numerous short blunt setae arising from tubercles (in *I. flava*, occasional large rodshaped setae present) (Fig. 36); acrostichal setae in 2–4 irregular rows on presutural area of scutum, becoming denser posteriorly; row of dorsocentral setae usually distinctly separated from acrostichal setae by bare space (Fig. 9), except in *I. scabricula*, which has completely diffused setal arrangement on thoracic dorsum; 2 blunt notopleural setae with posterior one always on strong tubercle; laterotergite with a large spinelike projection (Fig. 8); scutellum with 6–10 marginal tubercles (Fig. 9). **Legs.** Densely covered with short setae; hind basitarsus strongly thickened; hind tibia with 1 strong apicoventral spur. **Wings.** Usually hyaline to translucent; C reaching M; R_{4+5} and M more or less parallel; R_{4+5} bent forward at apex; CuA_1 usually reaching wing margin (Fig. 10). **Male abdomen** (Fig. 12, 13, 16, 17). Preabdomen with 4 distinct tergites and 4 distinct but reduced sternites; epandrium forming bonnetshaped sclerite; cerci always separated from epandrium; surstyli larger than cerci, variably shaped; aedeagal apo-

deme rodlike; basiphallus simple, evenly sclerotized; distiphallus highly specialized and autapomorphic for each species; paramere well developed with posterior process longer than anterior arm, anterior process with a long seta subapically. **Female abdomen** (Fig. 14 and 15). Preabdomen as in male; postabdomen membranous, telescoped, with 2 round spermathecae.

Key to the Species of *Ischiolepta* Lioy

1. Thoracic dorsum with 12 large rod-shaped setae (Fig. 36) in addition to dense minute setae; Afrotropical *flava* (Vanschuytbroeck)
- 2(1). Thoracic dorsum without such setae. 2
- 2(1). Total body length less than 1.75 mm; acrostichal and dorsocentral setae completely diffused; distiphallus with long down-curved ejaculatory duct held by long apical process (Fig. 140); Palearctic *scabricula* (Haliday)
- Total body length 2 mm or longer; 2–4 irregular rows of acrostichal setae distinctly separated from row of dorsocentral setae (Fig. 9); distiphallus without long apical process 3
- 3(2). Outer vertical seta on large tubercle (Fig. 109 and 143); marginal scutellar tubercles relatively thick and long, at least half as long as scutellum (Fig. 112 and 149) 4
- Outer vertical seta at most on small tubercle (Fig. 7); marginal scutellar tubercles short, less than half as long as scutellum (Fig. 9) 6
- 4(3). With 8 marginal scutellar tubercles; each tubercle yellow, bifurcate (Fig. 149); male genitalia large, with distiphallus evenly sclerotized and without any process (Fig. 151); Afrotropical *stuarti* Han and Kim, sp. n.
- With 7 marginal scutellar tubercles; tubercles not bifurcate, concolorous with scutellum; male genitalia not as above 5
- 5(4). Scutellum about 2.5 times as wide as long (Fig. 112); male sternite 5 entire; distiphallus large, with broad apical process; ejaculatory duct visible in lateral view (Fig. 114); Afrotropical *pansa* Han and Kim, sp. n.
- Scutellum about 1.5 times as wide as long; male sternite 5 divided; Afrotropical *vanschuytbroeckii* Papp
- 6(3). Setae on thoracic dorsum on weak tubercles, or setae longer than tubercles (Fig. 4); legs much paler than thoracic pleura; male hind femur usually strongly thickened, at least 1.5 times

- as thick as mid-femur (except in polymorphs of *I. pusilla* and *I. vaporariorum*) 7
- Setae on thoracic dorsum on strong tubercles, or setae shorter than tubercles (Fig. 9); legs as dark and opaque as thoracic pleura except in joint area; male hind femur long and slender, slightly thicker than mid-femur ... 14
- 7(6). Epistoma and clypeus yellow, contrasting well with dark frons; inner vertical setae long and inclined, reaching ocellar triangle 8
- Epistoma and clypeus dark, not contrasting well with frons; inner vertical setae short, never reaching ocellar triangle 9
- 8(7). Male hind femur strongly thickened, almost twice as thick as fore femur (Fig. 31); apex of surstylus rounded (Fig. 32); Palearctic *draskovitsae* Roháček & Papp
- Male hind femur slightly thicker than fore femur; apex of surstylus boot-shaped (Fig. 107); Palearctic and Oriental *orientalis* (de Meijere)
- 9(7). Genal area (supragena, infragena, and facial ridge) distinctly granulated .. 10
- Genal area not distinctly granulated .. 12
- 10(9). Scutellum with 10 marginal tubercles; Palearctic *longispina* Papp
- Scutellum with fewer than 10 marginal tubercles 11
- 11(10). Katepisternum of male ventrally with only sparse setae; male hind femur 1.5 times as thick as fore femur; male hind femur and hind tibia strongly bent dorsally; apical tubelike process of distiphallus short (Fig. 49); female abdominal sternite 5 divided into 2 sclerites (Fig. 46); Palearctic *horrida* Papp
- Katepisternum of male ventrally with dense, long, golden hairs; male hind femur as thick as fore femur, not bent dorsally; apical tubelike process of distiphallus long (Fig. 98); female abdominal sternite 5 entire; Palearctic *oedopoda* Papp
- 12(9). Thoracic dorsum shiny; male hind femur with small tubercle ventrally on basal $\frac{1}{4}$ (Fig. 84); distiphallus largely membranous with apex serrate (Fig. 85); Palearctic *nitida* (Duda)
- Thoracic dorsum pollinose; male hind femur without ventral tubercle; distiphallus not as above 13
- 13(12). Male cerci distinctly projecting ventrally (Fig. 125); dorsal sclerite of distiphallus apically hooked upward (Fig. 124); female cannot be separated from *I. vaporariorum* except by association with male; Cosmopolitan *pusilla* (Fallén)
- Male cerci not projecting ventrally (Fig. 160); dorsal sclerite of distiphallus projecting apically (Fig. 159); Holarctic *vaporariorum* (Haliday)
- 14(6). Knob of halter black; paramere long and slender with small anterior process (Fig. 17); Palearctic *crenata* (Meigen)
- Knob of halter pale, paramere variable 15
- 15(14). Acrostichal setae in 2 irregular rows on at least anterior $\frac{1}{3}$ of presutural area of scutum; body dull 16
- Acrostichal setae in 4 irregular rows on all of presutural area of scutum; body shiny 18
- 16(15). Paramere very large, slightly longer than surstylus (Fig. 25); female abdominal sternite 5 divided into 2 sclerites (Fig. 24); Palearctic .. *denticulata* (Meigen)
- Paramere much smaller than surstylus (Fig. 130); female abdominal sternite 5 entire (Fig. 56 and 134); Nearctic 17
- 17(16). Male abdominal tergite 5 entire; female preabdomen more or less parallel-sided (Fig. 54); female abdominal sternite 5 rectangular (Fig. 56) *intermedia* Han and Kim, sp. n.
- Male abdominal tergite 5 divided into 2 sclerites; female preabdomen oval in outline (Fig. 132); female abdominal sternite 5 peanut-shaped (Fig. 134) *scabra* (Spuler)
- 18(15). Abdomen oval in outline (Fig. 61-63); dorsal sclerite of distiphallus with 2 pairs of long projections (Fig. 67); female abdominal sternite 7 divided into 2 round sclerites, heavily sclerotized (Fig. 65); Palearctic *loebli* Roháček & Papp
- Abdomen more or less parallel-sided (Fig. 72 and 77); dorsal sclerite of distiphallus with 1 pair of small upward projections (Fig. 76); female abdominal sternite 7 represented only by weak longitudinal sclerites (Fig. 79); Holarctic *micropyga* (Duda)
- Ischiolepta crenata* (Meigen)**
(Fig. 5-17)
- Borborus crenatus* Meigen 1838: 407; Becker 1902: 349.
- Copromyza coronata* Zetterstedt 1840: 770; 1847: 2489.
- Sphaerocera coronata*; Schiner 1864: 327; Rondani 1880; Stenhammar 1855: 432-433; Becker 1905:

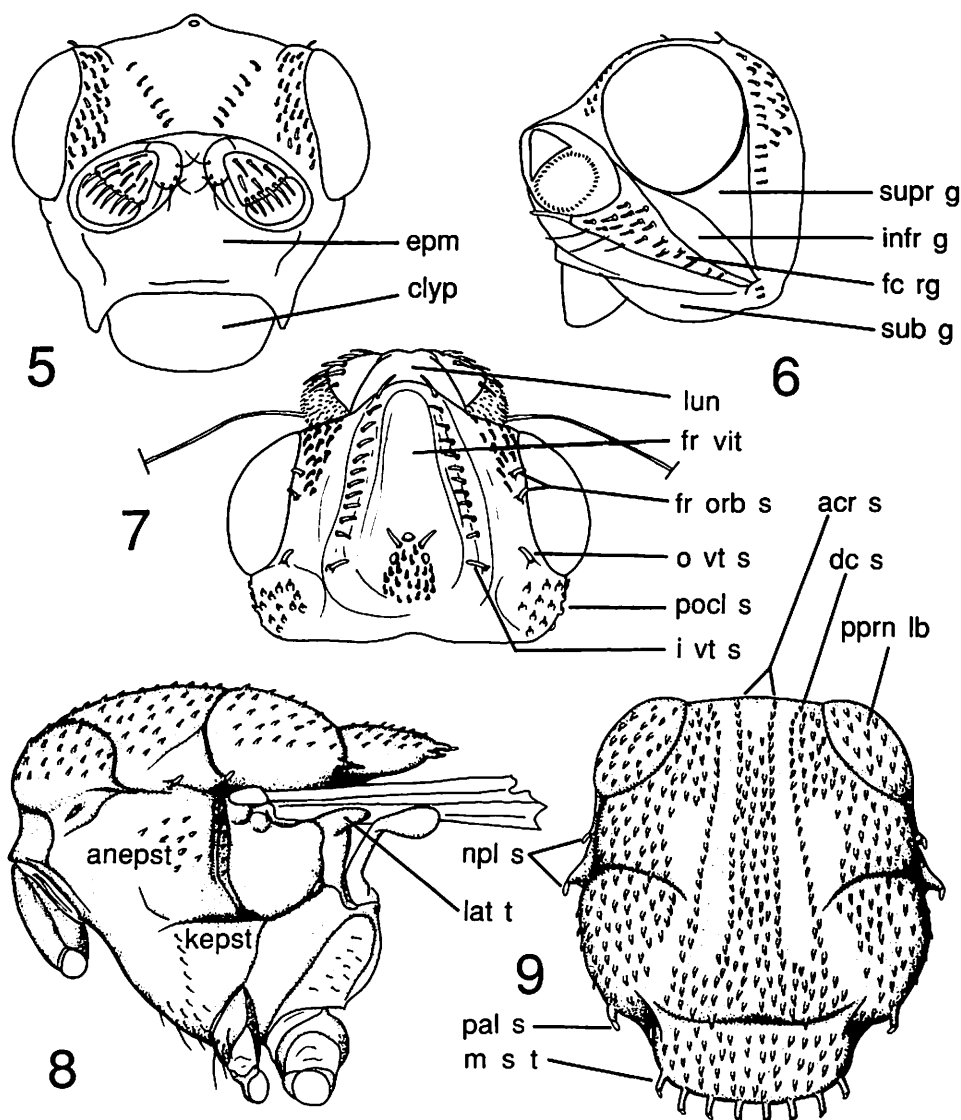


Fig. 5-9. *Ischiolepta crenata*, Male. (5) Head, frontal view. (6) Head, lateral view. (7) Head, dorsal view. (8) Thorax, lateral view. (9) Thorax, dorsal view. Abbreviations: acr s, acrostichal setae; anepst, anepisternum; clyp, clypeus; dc s, dorsocentral setae; epm, epistoma; fc rg, facial ridge; fr orb s, fronto-orbital seta; fr vit, frontal vitta; infr g, infragena; i vt s, inner vertical seta; kepst, katepisternum; lat t, laterotergite; lun, lunule; m s t, marginal scutellar tubercle; npl s, notopleural seta; o vt s, outer vertical seta; pal s, postalar seta; pocl s, postocular setae; pprn lb, postpronotal lobe; sub g, sub gena; suprg, supragena.

28; Duda 1920: 21-22; Richards 1930: 318; Séguy 1934: 453; Richards 1938: 128; Kim 1972a: 207. *Sphaerocera crenata*; Duda 1938: 27-28; Florén 1989: 3. *Ischiolepta crenata*; Hackman 1980: 147; Papp 1984: 70; Pitkin 1988: 34.

Diagnosis. This species can be easily distinguished from any other *Ischiolepta* species by the unique blackish halter.

Description. Entirely black, dull species; 2.62-3.65 mm long; most setae on strong tubercles.

Male. Head (Fig. 5-7). Black, subshiny; inter-

frontal setae marked by distinct ridges; lunule black, triangular; ocellar triangle glossy black with 3 black ocelli; inner vertical seta short, reaching halfway to ocellar triangle; outer vertical seta, fronto-orbital setae as long as inner vertical setae; outer vertical seta on distinct tubercle; postocular setae on small tubercles; epistoma black, subshiny, granulated; clypeus about twice as wide as long; gena black, subshiny; vibrissa thick and flattened; 2-3 long, hairlike subvibrissal setae present; facial ridge with dense setae on distinct tubercles; eye more or less round in lateral view with longest diameter about same as genal height. **Thorax.** Black, subshiny; most

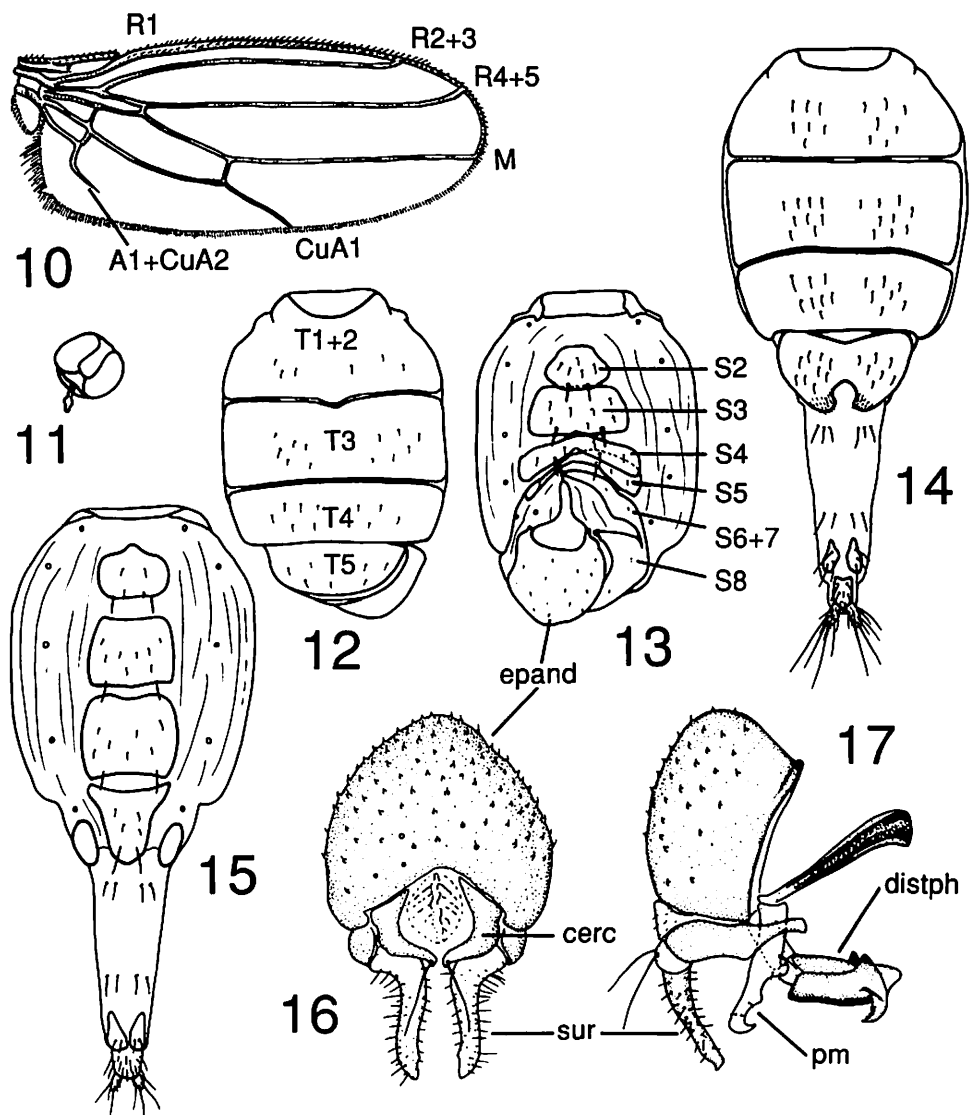


Fig. 10-17. *Ischiolepta crenata*. (10) Male: wing. (11) Female: spermatheca. (12) Male: abdomen, dorsal view. (13) Male: abdomen, ventral view. (14) Female: abdomen, dorsal view. (15) Female: abdomen, ventral view. (16) Male: genitalia, caudal view. (17) Male: genitalia, lateral view. Abbreviations: A1, anal vein; cerc, cerci; CuA1, CuA2, anterior branches of cubitus; distph, distiphallus; epand, epandrium; M, media; pm, paramere; R1 anterior branch of radius; R2+3 & R4+5, posterior branches of radius; S2-S8, sternites; T1-T5, tergites.

setae on strong tubercles, or setae usually shorter than tubercles; acrostichal setae in 2 rows on anterior $\frac{1}{2}$ of presutural area of scutum and in 4 irregular rows posteriorly; row of dorsocentral setae distinctly separate from acrostichal setae (Fig. 9), bare area between them heavily pollinose; scutellum black, subshiny, twice as wide as long, with 7-8 small marginal tubercles; katapisternum with sparse hairs ventrally. *Legs*. Black, slender; fore femur slightly thicker than middle and hind femur; hind tibia with strong apicoventral spur. *Wings* (Fig. 10). Membrane brownish; veins dark brown; halter with black knob and brown stem. *Abdomen*

(Fig. 12 and 13). Tergite 1+2 about 1.5 times as long as tergite 3; tergite 3 about 1.5 times as long as tergite 4; tergite 5 entire; sternite 2 more or less round; sternite 3 rectangular, twice as wide as long; sternite 4 and sternite 5 short and broad; genitalia large (Fig. 16 and 17); cerci short with long apical seta; surstylus slender, long, with anterior apex acute; paramere long with tiny anterior process; distiphallus longer than basiphallus, well sclerotized, apical part with pair of serrate ventral projections.

Female. Head, Thorax, Legs, Wings. As in male. *Abdomen* (Fig. 14 and 15). Tergite 1+2 and tergite

3 about equal in length; tergite 4 smaller; tergite 5 notched posteriorly; sternite 2 small, pointed anteriorly; sternite 3 and 4 more or less rectangular; sternite 5 divided into 3 sclerites, medial one bell-shaped, lateral ones small and round; postabdomen largely membranous.

Type Material. *Ischiolepta crenata*: LECTOTYPE: ♀ (here designated, labeled by Kim in 1969), the specimen with a "crenata Meigen" label which appears to be in Meigen's handwriting (MNHP, Box 61, #2641).

Ischiolepta coronata: Kim (1972a) examined a single female specimen with the labels "Naestansjö, Lappland, Zetterstedt" and "coronata Zetterstedt" (ZIUL), and called it the type of *Copromyza coronata* Zetterstedt. Because Zetterstedt (1840) failed to state how many females he had, it cannot be considered a holotype. Therefore we consider the statement by Kim (1972a) as a valid lectotype designation.

Other Material Examined. GERMANY: 1 ♂, Dachau, Miterna F., 18-V-1914 (ZMHU). SWEDEN: 1 ♀, Abisko, Lpl, 1-VII-1951, J. R. Vockeroth (UZI); 2 ♀♀, Stockholm, 1850, Boheman (UZI).

Distribution. Europe: England (Pitkin 1988), Finland (Hackman 1980), Germany, Sweden.

***Ischiolepta denticulata* (Meigen)**
(Fig. 18–26)

Borborus denticulatus Meigen 1830: 200.

Copromyza denticulata; Zetterstedt 1847: 2488–2489.

Sphaerocera paracrenata Duda 1920: 25 (lectotype examined).

Sphaerocera falcozi Duda in Falcoz 1921: 140.

Ischiolepta paracrenata; Papp 1978: 392; Roháček 1978: 244; Hackman 1980: 147; Pitkin 1988: 33.

Ischiolepta similis Papp 1978: 392–393; 1984: 71 (1 ♂, 1 ♀ paratypes in ZIL examined). **Syn. n.**

Ischiolepta denticulata; Papp 1984: 70; Florén 1989: 3.

(?) *Ischiolepta denticulata*; Papp 1978: 392; Hackman 1980: 147.

(?) *Ischiolepta falcozi*; Nishijima & Yamazaki 1984: 85–86.

Diagnosis. This species is closely related to the Nearctic *I. intermedia* and *I. scabra* but differs by the following characters: male paramere large, as long as or slightly longer than surstylus (Fig. 25); female sternite 5 divided into 2 sclerites (Fig. 24).

Description. Black, dull to subshiny species, 2.9–3.5 mm long; most setae on strong tubercles.

Male. Head (Fig. 18 and 19). Black, dull to subshiny; interfrontal setae marked by distinct ridges; lunule black, triangular; ocellar triangle black, subshiny with blackish gray ocelli; vertex dull; inner and outer vertical setae, fronto-orbital setae equal in length; outer vertical seta on distinct tubercle; postocular setae on small tubercles; epistoma black, subshiny, granulated; clypeus black, pollinose ex-

cept lower margin, about twice as long as wide; gena black, subshiny; vibrissa thick and flattened; 2–3 long, hairlike subvibrissal setae present; facial ridge with dense setae on distinct tubercles; eye round to elliptic in lateral view, with longest diameter about same as genal height. **Thorax.** Black, dull or subshiny; most setae on strong tubercles, or setae usually shorter than tubercles; acrostichal setae in 2 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them heavily pollinose; scutellum black, dull, twice as wide as long with 7–8 small marginal tubercles; katepisternum with only a few long hairs ventrally. **Legs.** Entirely black except brownish trochanter; hind femur long, slender; hind tibia with strong apicoventral spur. **Wings.** Membrane hyaline, tinged brown; veins brown; halter pale brown. **Abdomen** (Fig. 20 and 21). Sides more or less parallel; tergite 1+2, 3, 4 about same in length; tergite 5 divided into 2 round sclerites; sternite 3 larger than sternite 2, both more or less rectangular; sternite 4 and sternite 5 short and wide; genitalia (Fig. 25 and 26) with small cercus; surstylus slender, hairy, with small acute process subapically; paramere large, longer than or as long as surstylus, with anterior process about half as long as posterior process; distiphallus longer than basiphallus, with dish-shaped apicoventral process.

Female. Head, Thorax, Legs, Wings. As in male. **Abdomen** (Fig. 22–24). Tergite 1+2, 3, and 4 about equal in length; sternite 2 small; sternites 3 and 4 equal in size; tergite 5 and sternite 5 each subdivided into 2 round sclerites; abdominal segment 6 entirely membranous; both tergite 7 and sternite 7 represented by small transverse sclerites.

Type Material. *Ischiolepta denticulata*: LECTOTYPE: ♂ (here designated, labeled by Kim in 1969; see Remarks section) (NMW).

Sphaerocera paracrenata: LECTOTYPE (♀) and PARALECTOTYPE (♀) (here designated, labeled by Kim in 1966): Kohlfurt, Germany, 16/8, 40460, Th. Becker (ZMHU).

Ischiolepta similis: HOLOTYPE: ♂, Bolsh. oz. y Kljutschensk na r. Kamtsch. A Djergavin, USSR, 16. 4. [19]09. PARATYPES: same data as holotype. 2 ♂, 6 ♀ (ZIL), 1 ♂, 1 ♀ (HNHM). One male and one female paratypes (ZIL) were examined.

Other Material Examined. GERMANY: 2 ♀♀, Kahlfurt, 16/8 40460, T. Becker (ZMHU); 1 ♂, Lahn, 20852 (ZMHU); 1 ♂, Raudon, Os, 12-VIII-1932, Duda (ZMHU); 1 ♂ Raudon, Os, 11-IV-1932, Duda (ZMHU); 1 ♀, Reidel, Frankfurt Oder (ZMHU). ENGLAND: 1 ♂, 1 ♀, Buckinghamshire, Black Park, 25-V-1934 (ZMHU). SWEDEN: 8 ♂♂, 4 ♀♀, Stockholm, 1850, Boheman (UZI); 1 ♂, 1 ♀, Sm, 1850, Boheman, (UZI); 3 ♂♂, 2 ♀♀, Jamtland, 1840 (UZI).

Remarks. Meigen (1830) described *Borborus denticulatus* from an unstated number of specimens and a pair of specimens from the Winthem Collection, now deposited in NMW. Becker (1902)

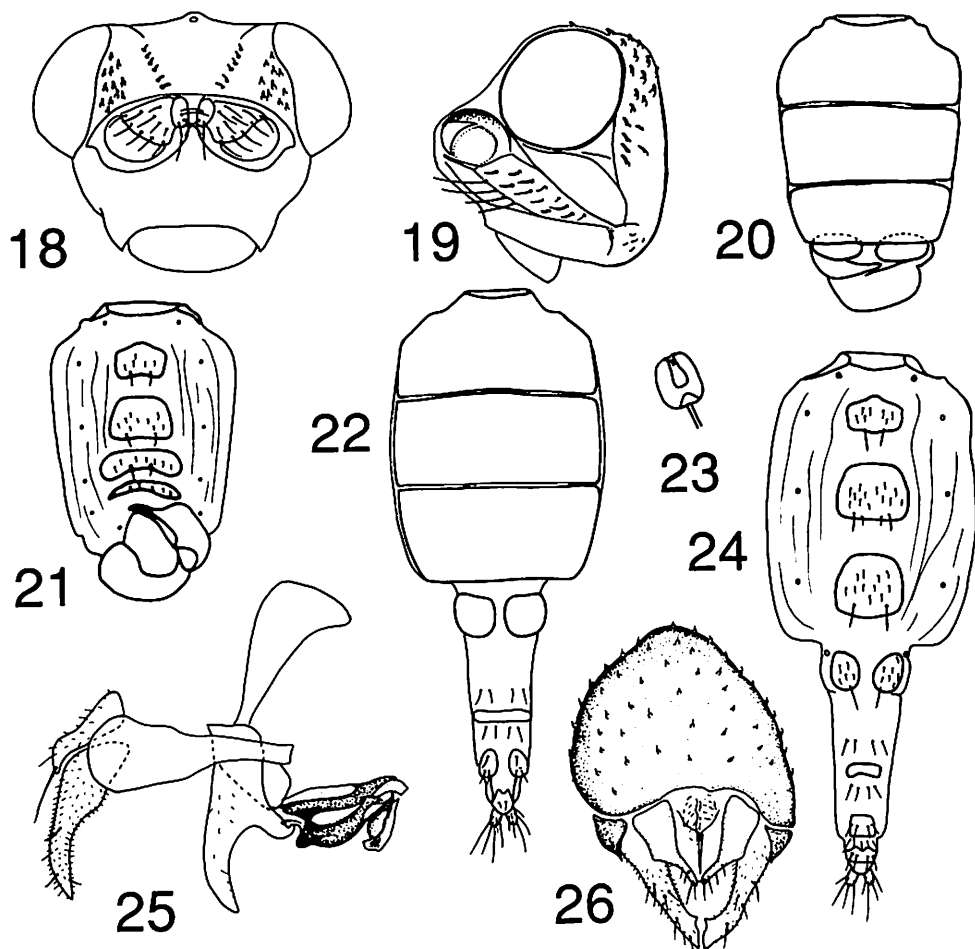


Fig. 18–26. *Ischiolepta denticulata*. (18) Male: head, frontal view. (19) Male: head, lateral view. (20) Male: abdomen, dorsal view. (21) Male: abdomen, ventral view. (22) Female: abdomen, dorsal view. (23) Spermatheca. (24) Female: abdomen, ventral view. (25) Male: genitalia, lateral view. (26) Male: genitalia, caudal view.

reported one female in MNHNP and 11 specimens in the Winthem Collection which agreed with Meigen's description; however, Richards (in Duda [1938]) indicated that the Paris specimen agreed with *I. nitida* Duda, whereas the Vienna specimens represented partly *I. parapusilla* Duda (= *I. vaporariorum* (Haliday)) and partly *I. micropyga* Duda. Kim found that the female from Paris labeled "*B. denticulata* Mg" (#2640, Box 61) actually was identical to *I. micropyga* (Duda), and a male from Vienna with three labels—"denticulata Coll. Winth.," "Type" (red paper), and "denticulata ♂ d. Duda"—was identical to *I. paracrenata* (Duda). There was no evidence that any of these labels (for both specimens) had been written by Meigen himself when the writing is compared with Meigen's labels in Plate 22, Fig. 7, and Plate 36, Fig. 4 of Horn & Kahle (1935–1937). Under these circumstances, and because Meigen's types include dull black specimens collected by Winthem (Meigen 1830), the Vienna specimen was more likely

to be one of the specimens that Meigen studied; we therefore designate it as lectotype.

Although the syntypes of *I. falcozi* were not available, we have examined a pair of specimens with Duda's determination label as *I. falcozi* (Buckinghamshire, England, 25-V-1934, ZMHU) which were found to be conspecific with *I. denticulata*. The discussion by Duda (1938) under the heading of *Sphaerocera paracrenata* also seems to support this observation.

Distribution. Europe: Czechoslovakia (Roháček 1978), England, Finland (Hackman 1980), Germany, Hungary (Papp 1978), Sweden, USSR.

***Ischiolepta draskovitsae* Roháček and Papp**
(Fig. 27–33)

Ischiolepta draskovitsae Roháček & Papp 1984: 472–474.

(?) *Ischiolepta yezoensis* Nishijima & Yamazaki 1984: 87–88. **Syn. n.**

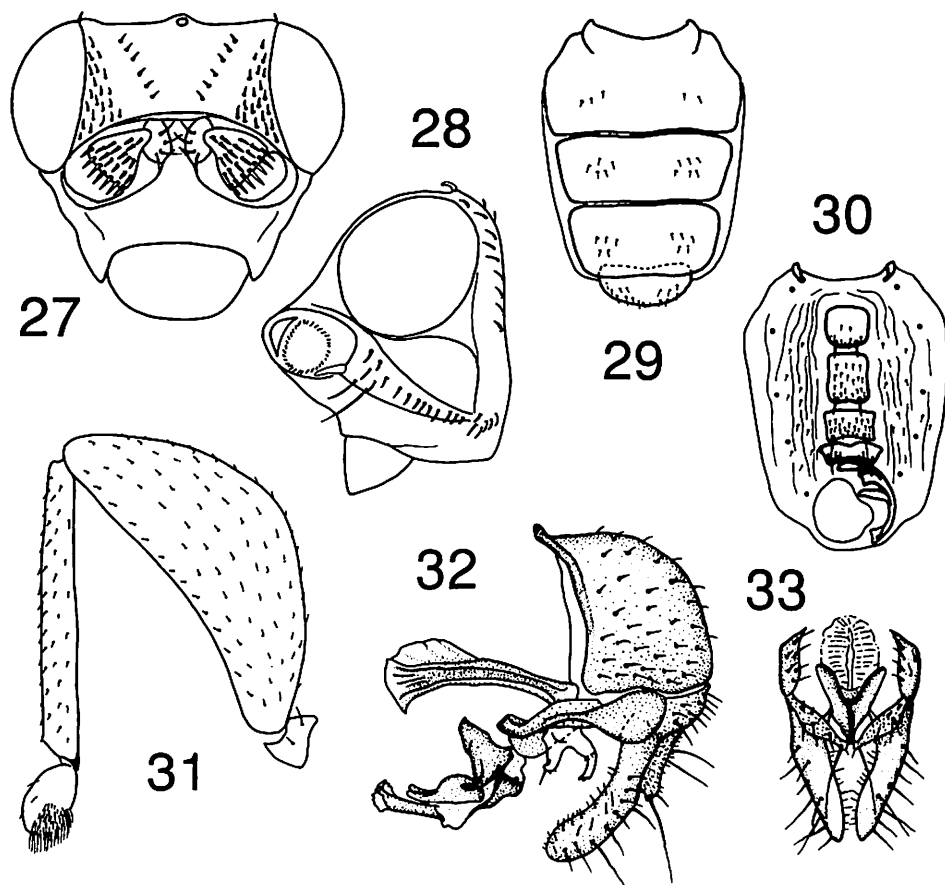


Fig. 27-33. *Ischiolepta draskovitsae*, Male. (27) Head, frontal view. (28) Head, lateral view. (29) Abdomen, dorsal view (after Roháček & Papp 1984). (30) Abdomen, ventral view (after Roháček & Papp 1984). (31) Hindleg (four distal tarsal segments removed). (32) Genitalia, lateral view (after Roháček & Papp 1984). (33) Genitalia, caudal view (after Roháček & Papp 1984).

Diagnosis. *Ischiolepta draskovitsae* is closely related to *I. orientalis* but differs in having the male hind femur strongly thickened, almost twice as thick as the fore femur (Fig. 31), and in having the apex of the surstylus rounded (Fig. 32).

Description. Subshiny, dark brown with yellow legs; 2.5 mm long.

Male (holotype). **Head** (Fig. 27 and 28). Epistoma, facial carina, and clypeus yellow, contrasting with dark brown frons; lunule large, triangular; inner vertical seta long, inclined, reaching ocellar triangle; outer vertical seta slightly tuberculate, half as long as inner vertical seta; postocular setae not on tubercles; infragena shiny, smooth, dark brown; vibrissa thick and flattened; 3 long, hairlike subvibrissal setae present; facial ridge with dense hairlike setae; eye more or less elliptic in lateral view. **Thorax.** Black, dull; most setae on weak tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acros-

tichal setae, bare area between them slightly polinose, subshiny; scutellum dark brown, subshiny, twice as wide as long, with 8 small marginal scutellar tubercles; katapisternum with sparse long hairs ventrally. **Legs.** Yellow, contrasting with dark thoracic pleura; hind femur (Fig. 31) strongly thickened, almost 3 times as thick as middle femur; fore femur 1.5 times as thick as middle femur; hind tibia with strong apicoventral spur. **Wings.** Membrane translucent, yellowish; veins brownish yellow; halter pale brown. **Abdomen** (Fig. 29 and 30). Tergite 1+2 about 1.5 times as long as tergite 3; tergite 3 and tergite 4 about same in size; tergite 5 half as long as tergite 4, entire; sternite 2 rectangular; sternite 3 elongate, sternite 4 twice as wide as long; sternite 5 narrow; genitalia (Fig. 32 and 33) with surstylus long, rounded apically in lateral view; paramere small with dark pigmented anterior projection with long seta; distiphallus long, basally with robust dorsally protruding sclerite bearing a lateral hook, subapically with dorsal

sclerite ending in a pair of pale fingerlike projections and apically with tubelike unpaired sclerite (Roháček & Papp 1984).

Female. Unknown.

Type Material. *Ischiolepta draskovitsae*: HOLOTYPE: ♂ Mt. Kum Gang-San, 7 km W of Hotel Kum Gang, North Korea, 11-VII-1977, Draskovits-Dely (No. 358) (HNHM). Unfortunately, the holotype, which had been borrowed by H.-Y. H., was damaged enroute to HNHM: the fore legs and right middle leg were lost, and other legs were damaged (Papp, personal communication).

Ischiolepta yezoensis: HOLOTYPE: ♂, Atsunai, Tokachi, Japan, 22-VII-1951, Y. Nishijima (LEOU). PARATYPES: 1 ♂, same data as holotype; 3 ♂♂, Asahikawa, Kamikawa, Japan, 29-IV-1978, K. Yamazaki; 1 ♂, Obihiro, Japan, 25-IV-1976, K. Yamazaki (LEOU). None of *I. yezoensis* types were examined (see Remarks).

Distribution. Korea, Japan (Nishijima & Yamazaki 1984).

Remarks. As Roháček indicated (personal communication), *I. yezoensis* Nishijima and Yamazaki is most likely conspecific with *I. draskovitsae*, which also has an orange-yellow prefrons and an apically rounded male surstylus. We concur with his taxonomic judgement, although the original description and illustration do not provide any further clue to the identity of this species. Our numerous attempts to obtain type specimens or other information about *yezoensis* from Nishijima and Yamazaki failed. Thus, our synonymic treatment should be considered tentative.

***Ischiolepta flava* (Vanschuytbroeck), comb. n.**
(Fig. 34-39)

Lotobia flava Vanschuytbroeck 1951: 3-4; Richards 1980: 625.

Lotobia kifarzensis Vanschuytbroeck 1959b: 39-40; Richards 1980: 625 (holotype examined). Syn. n.

Diagnosis. This peculiar species can be easily distinguished from any other species of *Ischiolepta* by its long rodshaped setae and largely membranous abdomen. It is related to *I. stuarti* and *I. pansa*, which have a similar outer vertical tubercle and scutellum. Unfortunately, the male genitalia, which might provide characters to indicate better the relationship of *I. flava*, were found to be destroyed in the holotype of *L. kifarzensis*, the only male available for study.

Description. Shiny to subshiny, brown; about 1.8 mm long; small species with occasional huge rod-shaped setae.

Male. Head (Fig. 34 and 35). Brown, subshiny; frons distinctly concave; lunule large, triangular; inner vertical seta indistinguishable; outer vertical seta, fronto-orbital setae, ocellar seta huge, subequal to vibrissa; outer vertical seta on very large tubercle (Fig. 35); few tiny postocular setae pres-

ent; epistoma yellowish brown; clypeus relatively small, 5 times as wide as long; gena brown, smooth; vibrissa thick and blunt, slightly longer than pedicel; pedicel with only few flattened setae; eye relatively small with diameter 0.7 times as long as genal height. **Thorax** (Fig. 36). Brown, shiny, with numerous tiny setae on very weak tubercles and 12 extremely large rodshaped setae on dorsum; acrostichal setae in 4 irregular rows; dorsocentral setae not easily distinguished from other setae; 2 notopleural setae as long as outer vertical setae, with hind one on large tubercle; postalar seta on long, thick tubercle; scutellum 2.5 times as wide as long, with 6 long, thick marginal tubercles, each tubercle with relatively long blunt seta at apex. **Legs.** Yellowish brown, slender. **Wings.** Membrane hyaline; veins brown; halter pale yellow. **Abdomen** (Fig. 37). Largely membranous; tergites weakly sclerotized, numerous small round sculpture patterns visible when stained; tergite 1+2 and tergite 3 almost fused; sternites almost indistinguishable.

Female. Head, Thorax, Legs, Wings. As in male. **Abdomen** (Fig. 38). Tergites weakly sclerotized with lateral margins more hardened, sculptured as in male; sternites indistinguishable; postabdomen relatively short.

Type Material. *Ischiolepta flava*: HOLOTYPE: ♀ Ela, Congo Belge (Zaire), 20-V-1935, on elephant excrement, J. Ghesquiere (IRSN).

Ischiolepta kifarzensis: HOLOTYPE: ♂, Park National Garamba, Congo Belge (Zaire), II/Je/4, 26-VIII-1952, H. de Seager (MRAC). PARATYPES: 1 ♀, same data as type; 1 ♂, same data as type except I/c/I, 8-II-1950 (IRSN). See Vanschuytbroeck (1959b) for additional paratype data.

Distribution. Known only from Zaire.

***Ischiolepta horrida* Papp**
(Fig. 40-49)

Ischiolepta horrida Papp 1973b: 370-371; 1978: 392; 1984: 70; Roháček & Papp 1984: 477-478.

Diagnosis. *Ischiolepta horrida* is closely related to *I. oedopoda* and *I. longispina*, which also have the genal area extensively granulated. It can be distinguished from them by the following characters: scutellum with fewer than 10 marginal tubercles; male hind femur and hind tibia strongly bent dorsally; female sternite 5 divided into 2 sclerites (Fig. 46).

Description. Dark brown; about 2.0 mm long.

Male. Head (Fig. 40 and 41). Dark brown; lunule small, crescentic; inner vertical setae, outer vertical setae, 2 pairs of fronto-orbital setae distinct, all equal in length, on weak tubercles; postocular setae on weak tubercles; epistoma granulated, dark brown with brownish tinge on upper half; clypeus dark brown, pollinose, about twice as wide as long; gena brown; supragena, infragena, and facial ridge extensively granulated; facial ridge with thick and flattened vibrissa, 3 long subvibrissal setae and

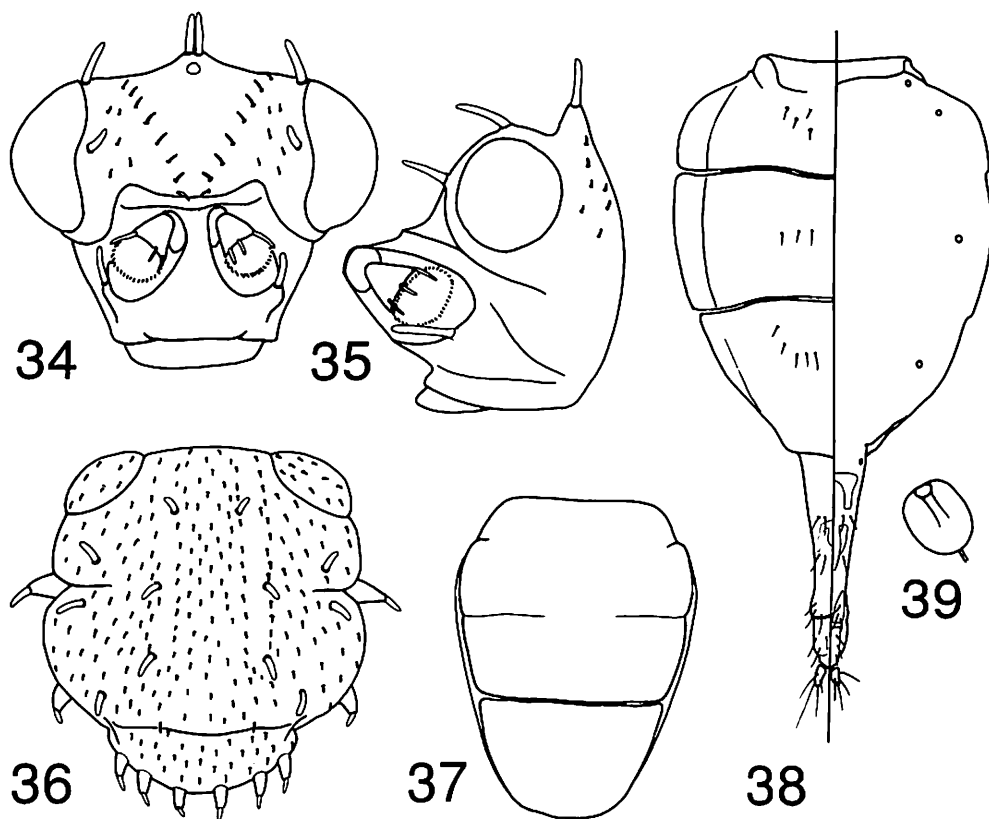


Fig. 34-39. *Ischiolepta flava*. (34) Male: head, frontal view. (35) Male: head, lateral view. (36) Male: thorax, dorsal view. (37) Male: abdomen, dorsal view. (38) Female: abdomen, dorsal and ventral view. (39) Spermatheca.

sparse, short, hairlike setae; eye more or less elliptic in lateral view with longest diameter as long as genal height. **Thorax.** Dark brown; most setae on weak tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows; row of dorso-central setae distinctly separate from acrostichal setae, bare area between them slightly pollinose; scutellum twice as wide as long with 9 relatively small marginal tubercles; katapisternum with sparse hairs ventrally. **Legs.** Brownish yellow, contrasting with dark brown thoracic pleura; fore femur 1.4 times as thick as middle femur; hind femur (Fig. 47) 2.2 times as thick as middle femur; hind femur and hind tibia strongly bent dorsally. **Wings.** Membrane hyaline; veins brown; halter pale brown. **Abdomen** (Fig. 42, 43). Rather narrow; slightly tapered posteriorly; tergite 1+2 about 1.5 times as long as tergite 3; tergite 3 and tergite 4 equal in length; tergite 5 small but entire; sternite 1 represented by 2 small sclerites; sternite 2 small, about 0.7 times as long as sternite 3; sternite 3 and sternite 4 about equal in size; genitalia (Fig. 48 and 49) with paramere as long as basiphallus, posterior process long and gently hooked; distiphallus with tube-like frontal process and 2 pairs of dorsally turned hooks laterally.

Female. Head, Thorax, Wings. As in male. **Legs.** Femur not thickened. **Abdomen** (Fig. 44-46). Tergite 1+2 and tergite 4 about equal in length; tergite 3 slightly shorter than tergite 1+2; tergite 5 small but entire; S1 represented by 2 tiny sclerites; sternite 2 subrectangular, sternite 3 about 1.5 times as long as sternite 2, more or less trapezoidal; sternite 4 largest, more or less triangular; sternite 5 divided into 2 sclerites; postabdomen largely membranous; cerci short.

Type Material. HOLOTYPE: ♂, Dasincsilen (Bulgan aimak), Mongolia, 2-VIII-1971, P. Somogyi. PARATYPES: (all Mongolia, all HHNM): 3 ♂, 3 ♀, same data as holotype; 1 ♂, 1 ♀, Central aimak: Ulan-Baator, 25-VII-1971; 1 ♂, Uubulan am Fluss Tola, 60 km O von Ulan-Baator, 1,370 m, 25-VIII-1965 (Nr. 481); 4 ♂♂, 1 ♀, Altan Bulag, 13-VII-1971; 2 ♂♂, Dzargaland, 6-VII-1971. Archangaj aimak: 1 ♀, Ichtamir, 27-VII-1971. Cojbalsan aimak: 1 ♀, Jengijntal, 160 km W vom See Bujr nurm 600 m, 15-VIII-1965 (Nr. 416). The type series was collected on horse (occasionally on yak) dung. One male and one female paratypes from Dzargaland and Dasincsilen were examined.

Distribution. Known only from Mongolia (Papp 1973b).

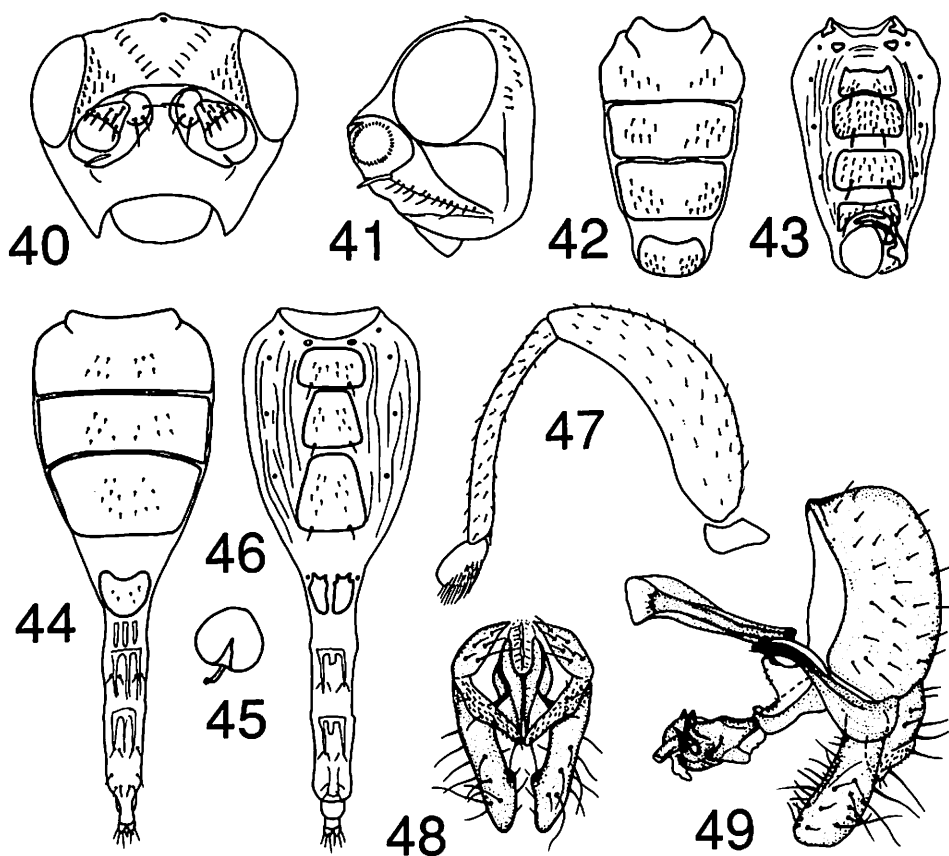


Fig. 40–49. *Ischiolepta horrida*. (40) Male: head, frontal view. (41) Male: head, lateral view. (42) Male: abdomen, dorsal view (after Roháček & Papp 1984). (43) Male: abdomen, ventral view (after Roháček & Papp 1984). (44) Female: abdomen, dorsal view. (45) Spermatheca. (46) Female: abdomen, ventral view. (47) Male: hindleg (four distal tarsal segments removed). (48) Male: genitalia, caudal view (after Roháček & Papp 1984). (49) Male: genitalia, lateral view (after Roháček & Papp 1984).

Ischiolepta intermedia Han and Kim, sp. n.
(Fig. 50–58)

Diagnosis. *Ischiolepta intermedia* is closely related to the Palearctic *I. denticulata* and the Nearctic *I. scabra*, which share a dishshaped apical process on the distiphallus. Males of *I. intermedia* can be easily distinguished from those of the other two species by the entire abdominal tergite 5. Although the *I. intermedia* female can be distinguished from the female of *I. denticulata* by having an entire abdominal sternite 5, it is very similar to the female of *I. scabra* and can be distinguished by the following characters: preabdomen parallel-sided (Fig. 54, compare with Fig. 132), and abdominal sternite 5 rectangular (Fig. 56), not peanutshaped as in *I. scabra* (Fig. 134).

Description. Entirely black, dull to subshiny species, 3.2–3.3 mm long; most setae on strong tubercles.

Male. Head (Fig. 50 and 51). Black, subshiny; interfrontal setae marked by distinct ridges; lunule

reddish black, triangular; inner vertical seta, outer vertical seta, 2 orbital setae about same in length, on distinct tubercles; postocular setae on small but distinct tubercles; epistoma black, subshiny, granulated; clypeus black, pollinose except lower margin, about twice as wide as long; gena shiny black; vibrissa thick and flattened; 3–4 long, hairlike subvibrissal setae present; facial ridge with dense blunt setae on distinct tubercles; eye more or less round in lateral view with longest diameter about same as genal height. **Thorax.** Black, dull or subshiny; most setae on strong tubercles, or setae shorter than tubercles; acrostichal setae in 2 rows on anterior half to $\frac{1}{3}$ of presutural area of scutum and in 4 irregular rows posteriorly; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them heavily pollinose; scutellum black, subshiny, twice as wide as long, with 7 marginal tubercles; katapisternum with 1–2 long hairs ventrally. **Legs.** Black, opaque except trochanter and joint areas; hind femur long, slender; hind tibia with strong apicoventral spur; fore femur slightly

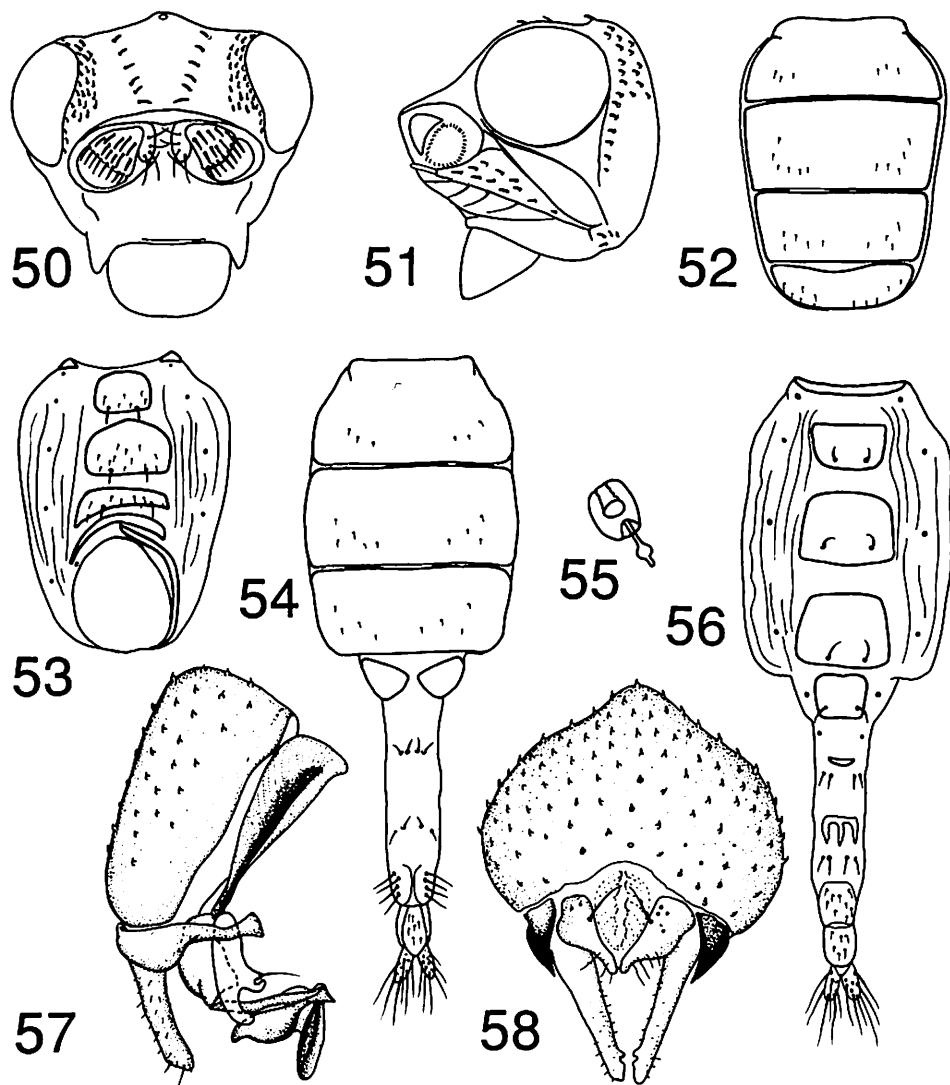


Fig. 50–58. *Ischiolepta intermedia*. (50) Male: head, frontal view. (51) Male: head, lateral view. (52) Male: abdomen, dorsal view. (53) Male: abdomen, ventral view. (54) Female: abdomen, dorsal view. (55) spermatheca. (56) Female: abdomen, ventral view. (57) Male: genitalia, lateral view. (58) Male: genitalia, caudal view.

thickened. *Wings*. Membrane pale brown, translucent; veins brown; halter pale brown. *Abdomen* (Fig. 52 and 53). Three preabdominal tergites about equal in length; tergite 5 entire, about half as long as other preabdominal tergites; sternite 3 about 1.5 times as long as sternite 4; sternite 4 and sternite 5 narrow; genitalia (Fig. 57 and 58) with epandrium large; hypandrial apodeme short, paramere as long as distiphallus with rather short frontal process; distiphallus with dishshaped apicoventral process.

Female. *Head*, *Thorax*, *Legs*, *Wings*. As in male. *Abdomen* (Fig. 54–56). Tergite 1+2, tergite 3, tergite 4 almost equal in size; tergite 5 subdivided into 2 triangular sclerites; sternites 2–5 more or less rectangular; sternite 3 about 1.5 times as long as

sternite 2; sternites 3 and 4 about same in size; sternite 5 half as long as sternite 4; postabdomen normal.

Type Material. HOLOTYPE: ♂, Lanark, Ontario, on decaying mushroom, 1-IX-1979, S. A. Marshall (CNC). PARATYPES: CANADA: Alberta: 1 ♀, Banff, 13-IV-1930, O. Bryant (GUE); 1 ♀, Edmonton, lot 301, 1932, O. Bryant (CNC). Ontario: 1 ♂, Mer Blue Bog, Ottawa, 18-VIII-1979, S. A. Marshall (GUE); UNITED STATES: Oregon: 1 ♀, Klamath Co., 4 mi N Beatty, 24°, 5-V-1961, J. Schuh, E. Hanson (CNC).

Other Material Examined. CANADA: Ontario: 3 ♀♀, Luther Lake, 24-V-1980, S. A. Marshall (GUE); 1 ♀, Elk Island Natl. Park, Trail 6, sweeping on moose dung, 13-V-1982, R. S. Anderson (GUE).

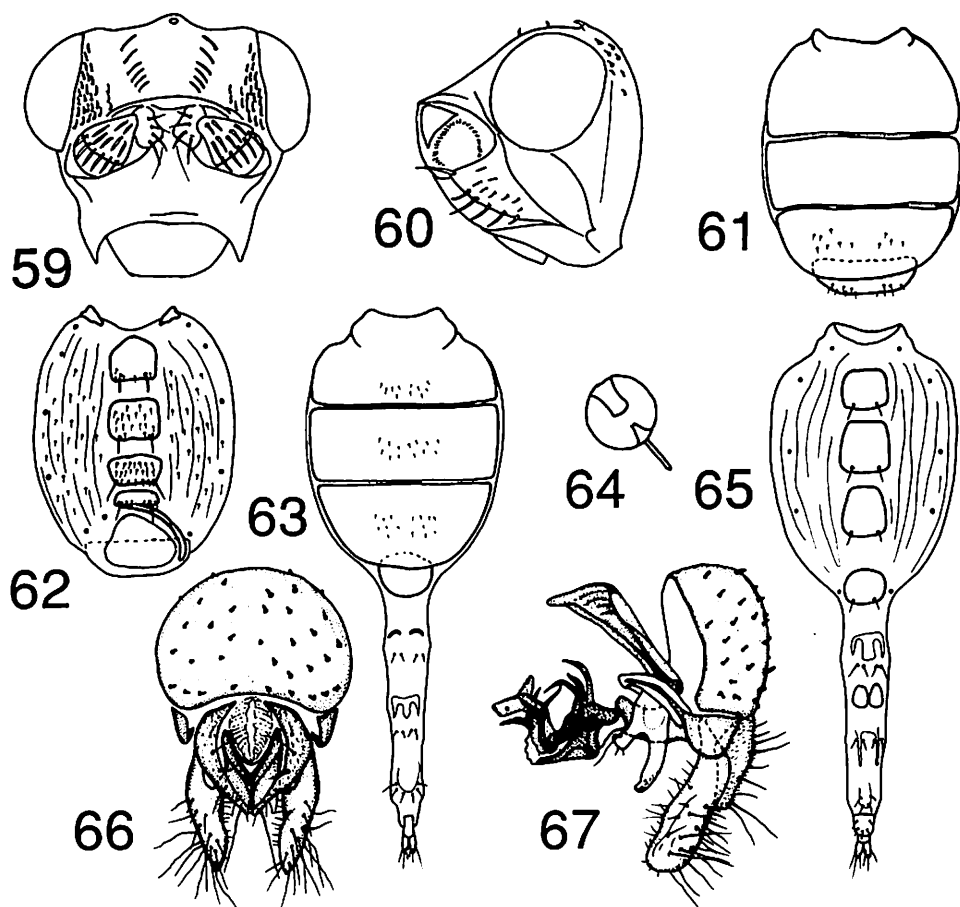


Fig. 59–67. *Ischiolepta loebli*. (59) Female: head, frontal view. (60) Female: head, lateral view. (61) Male: abdomen, dorsal view (after Roháček & Papp 1984). (62) Male: abdomen, ventral view (after Roháček & Papp 1984). (63) Female: abdomen, dorsal view. (64) Spermatheca. (65) Female: abdomen, ventral view. (66) Male: genitalia, caudal view (after Roháček & Papp 1984). (67) Male: genitalia, lateral view (after Roháček & Papp 1984).

Distribution. Nearctic: Ontario to Alberta and Oregon.

Etymology. The specific epithet is derived from the Latin *intermedius*, referring to the male genitalia which are intermediate between *I. scabra* and *I. denticulata* in structure.

***Ischiolepta loebli* Roháček and Papp**
(Fig. 59–67)

Ischiolepta loebli Roháček & Papp 1984: 470–472; Papp 1988: 466.

Diagnosis. *Ischiolepta loebli* superficially resembles *I. micropyga* by having a black subshiny body, but is distinguishable from it by: abdomen oval in outline (Fig. 61 and 63), dorsal sclerite of distiphallus with 2 pairs of long projections (Fig. 67), and venter of female abdominal segment 7 with 2 round sclerites (Fig. 65).

Description. Entirely black, subshiny species, 2.14–2.57 mm long; most of setae on strong tubercles.

Male. Head (Fig. 59 and 60). Black, subshiny; fronto-orbital plate dark brown; lunule triangular; inner vertical seta distinct, reaching halfway to ocellar triangle; outer vertical seta on distinct tubercle, subequal to inner vertical seta; 2 fronto-orbital setae, distinct; postocular setae on weak tubercles; epistoma black, granulated; clypeus large, about twice as wide as long; gena black, subshiny; facial ridge with thick, flattened vibrissa and 4 long, hairlike subvibrissal setae; eye more or less round in lateral view with longest diameter about same as genal height. **Thorax.** Black, subshiny; most setae on strong tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them subshiny, slightly pollinose; scutellum black,

twice as wide as long with 7 marginal scutellar tubercles; katapisternum with few long hairs ventrally. *Legs*. Entirely black except dark brown trochanter and joint area; fore and hind femora slender, slightly thicker than middle femur; hind tibia with small apicoventral spur. *Wings*. Membrane hyaline; veins brown; halter pale. *Abdomen* (Fig. 61 and 62). Oval in outline; tergite 1+2 about 1.5 times as long as tergite 3; tergite 4 slightly longer than tergite 3; tergite 5 smallest, entire; sternite 2 semicircular; sternite 3 more or less rectangular; sternite 4 shorter but slightly wider than sternite 3; sternite 5 very short; genitalia (Fig. 66, 67) with surstylus gently rounded apically; paramere with posterior process twice as long as anterior process; distiphallus with 2 pairs of long, slender dorsal processes with apical one forked.

Female. Head, Thorax, Legs, Wings. As in male. *Abdomen* (Fig. 63-65). Broad; tergite 1+2 and tergite 4 about equal in length; tergite 3 rectangular, slightly shorter than tergite 1+2; tergite 5 small but entire; preabdominal sternites very small, all about equal in size; postabdomen largely membranous, with sternite 7 represented by 2 distinctly dark, round sclerites.

Type Material. HOLOTYPE: ♂, Uttar Pradesh, 2 km E of Dhanolti, N. India, 21-X-1979, I. Loeb (MHNG). PARATYPES: 3 ♀ (MHNG), 1 ♂, 2 ♀ (HNHM), 1 ♀ (SMC), same data as holotype. One of these females was examined.

Other Material Examined. PAKISTAN: 1 ♂, Swat, Maln Jabba, 18-V-1983, Loeb (HNHM).

Distribution. India, Pakistan.

Ischiolepta longispina Papp
(Fig. 68-70)

Ischiolepta longispina Papp 1973b: 371; 1978: 392; 1984: 70.

Diagnosis. *Ischiolepta longispina* is closely related to *I. oedopoda* and *I. horrida*, which also have an extensively granulated genal area that we hypothesize as apomorphic. Their phylogenetic relationship cannot be completely confirmed because males of *I. longispina* are unknown. It can be distinguished from the related species by having 10 marginal scutellar tubercles.

Description. *Female.* Dark brown to brown, 2 mm long. *Head* (Fig. 68 and 69). Frons dark brown with anterior portion yellowish brown; lunule small, crescentic; inner vertical seta indistinguishable; outer vertical seta very small, barely distinguishable, not on tubercle; epistoma brown, granulated, relatively short; clypeus about twice as wide as long; gena dark brown with subgena half as high as infragena; supragena, infragena, and facial ridge extensively granulated; vibrissa thick, flattened; 3 long, hairlike subvibrissal setae present; eye more or less round in lateral view with longest diameter about same as genal height. *Thorax*. Dark brown, subshiny; most setae not on tubercles or on very

weak tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them subshiny, slightly pollinose; scutellum dark brown, twice as wide as long, with 10 marginal scutellar tubercles; katapisternum with few long hairs ventrally. *Legs*. Brown; fore and hind femur strongly thickened, both about 1.5 times as thick as middle femur; hind tibia with distinct apicoventral spur. *Wings*. Membrane hyaline; veins brown; halter pale brown. *Abdomen* (Fig. 70). Sternite 1 narrow, striplike; sternite 2 semicircular, large; sternite 3 bell-shaped, narrow, about 1.5 times as long as sternite 2; sternite 4 subequal to sternite 3, same shape as sternite 3; sternite 5 small, entire; postabdomen not examined.

Male. Unknown.

Type Material. HOLOTYPE: ♀, Dasincsil, Mongolia, on yak and horse dung, 2-VIII-1971, P. Somogyi (HNHM). The abdomen of this specimen is permanently mounted in balsam. Unfortunately, the holotype, which had been borrowed by the senior author, was damaged enroute to HNHM: the left middle leg and the fore and middle tarsomeres have been lost (L. Papp, personal communication).

Distribution. Known only from the type locality in Mongolia.

Ischiolepta micropyga (Duda)
(Fig. 71-79)

Boborus denticulatus Meigen (*partim*) 1830: 200. *Sphaerocera micropyga* Duda 1938: 29.

Sphaerocera denticulata; Stenhammar 1855: 433; Schiner 1864: 326; Duda 1920: 23; Seguey 1934: 453 (misidentification).

Ischiolepta micropyga; Roháček 1978: 244; Papp 1978: 392; 1984: 70; Florén 1989: 3.

Diagnosis. *Ischiolepta micropyga* resembles *I. loebli* in having a black, shiny body but differs by having the abdomen more or less parallel-sided (Fig. 72, 77), and the dorsal sclerite of the distiphallus with a pair of small projections pointing upward (Fig. 76).

Description. Entirely black species; subshiny, 2.6-2.7 mm long.

Male. Head (Fig. 71 and 74). Black, dull to subshiny; lunule shiny black, triangular; ocellar triangle black, subshiny; inner vertical seta small, almost indistinguishable; outer vertical seta on distinct tubercle; 2 fronto-orbital setae small but distinct; postocular setae on weak tubercles; epistoma black, granulated; clypeus black, pollinose except lower margin, about 1.5 times as wide as long; gena shiny black; setae on the facial ridge hairlike with thick vibrissa and 3-4 long subvibrissal setae; eye elliptic in lateral view with longest diameter about same as genal height. *Thorax*. Black, subshiny; most setae on strong tubercles or setae usually shorter than tubercles; acrostichal setae in 4 irregular rows on

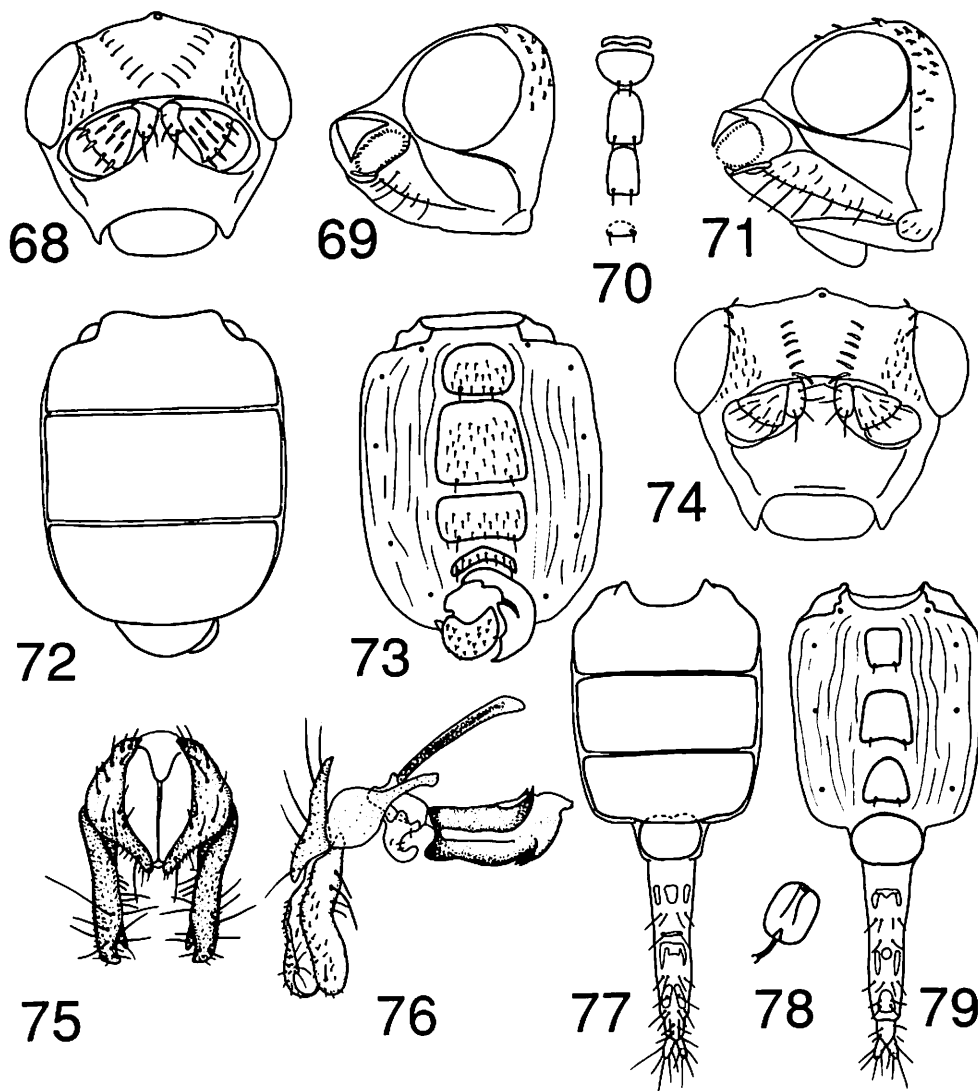


Fig. 68-70. *Ischiolepta longispina*. (68) Female: head, frontal view. (69) Female: head, lateral view. (70) Female: preabdominal sternites (after Papp 1973b). Fig. 71-79. *Ischiolepta micropyga*. (71) Male: head, lateral view. (72) Male: abdomen, dorsal view. (73) Male: abdomen, ventral view. (74) Male: head, frontal view. (75) Male: genitalia, caudal view. (76) Male: genitalia, lateral view. (77) Female: abdomen, dorsal view. (78) Spermatheca. (79) Female: abdomen, ventral view.

presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them shiny, almost not pollinose; scutellum black, subshiny, twice as wide as long, with 7-8 marginal tubercles; katapisternum without long hairs ventrally. *Legs*. Entirely black except brownish trochanters and joint area; hind femur long and slender; hind tibia with small apicoventral spur. *Wings*. Membrane hyaline; veins brown; halter pale brown. *Abdomen* (Fig. 72 and 73). Broad, more or less parallel sided; tergite 1+2, tergite 3, and tergite 4 almost equal in length; tergite 5 small, entire; sternite 3 about 1.5 times as long as sternite 2; sternite 4 rectangular, twice as wide as long; ster-

nite 5 small, short; genitalia (Fig. 75 and 76) with surstylus long, straight, with apex rounded in lateral view, with small process subapically in caudal view; paramere small with apex strongly curved anteriorly; distiphallus twice as long as basiphallus, dorsal sclerite hooked upward, apex of ventral sclerite forming small downward-projecting tooth.

Female. Head, Thorax, Legs, Wings. As in male. *Abdomen* (Fig. 77-79). Broad, more or less parallel-sided; tergite 1+2, tergite 3, and tergite 4 almost equal in size; tergite 5 entire, small, round; sternite 2, sternite 3, and sternite 4 equal in size; sternite 5 round, relatively large; postabdomen largely membranous.

Type Material. LECTOTYPE (here designated, labelled by Kim in 1966): ♂, Ilfeld, s-Harz Mt., Germany. Duda, 739415, (ZMHU). PARALECTOTYPES (all ZMHU): 1 ♂, Lähn, Germany, F. W859, Becker's Coll.; 1 ♂, Brechelshof, 20/7 40155, Becker's Coll.

Other Material Examined. ENGLAND: 1 ♀, 20-II-1882, Haliday (NCID). GERMANY: 1 ♀, Wustung b. Habelschwerdt, 6-V-1922, Duda (ZMHU). SCOTLAND: 1 ♀, Cardross, 18-VII-1908, J. R. Malloch (USNM). CANADA: Alberta: 1 ♀, Elkwater, 2-VI-1955, J. R. Vockeroth (CNC); 1 ♀, Belby, 12-VII-1924, O. Bryant (CNC); 2 ♀♀, Cypress Hills, cow dung, 14-VI-1980, S. A. Marshall (GUE). British Columbia: 1 ♂, Merrite, 3-VIII-1901, R. H. Beamer (CNC); 1 ♀, Carbonate Columbia River 2,600', 7-12-VII-1908, J. C. Bradley (USNM); 2 ♀♀, Kaslo, 15-VI-1924 (USNM). Ontario: 4 ♀♀, Carp, 22-IV-1954, J. F. McAlpine (CNC); 1 ♂, Bells Corners, 17-V-1947 (CNC); 1 ♂, Ottawa, 20-IV-1955, J. F. McAlpine (CNC); 3 ♀♀, Algonquin Park, 8-VII-1957, G. F. Bennet (USNM); 1 ♀, 1 ♂, Algonquin Park, 5-VII-1957, G. F. Bennet (USNM). Saskatchewan: 9 ♂♂, 6 ♀♀, Gt. Sand Hills, on antelope dung, 27-V-1955, J. R. Vockeroth, 5,008' 109-16 (CNC); 2 ♂♂, Willows, 17-VI-1955, J. R. Vockeroth (CNC); 1 ♂, 2 ♀♀, Assiniloia, 16-VII-1955, J. R. Vockeroth (CNC). UNITED STATES: Arizona: 1 ♀, Apache Co., 25 mi W Springerville, Green Peak, 10,100', forest-meadow malaise, 10-13-VII-79. S. & J. Peck (GUE); 1 ♂, 10 mi NW Flagstaff, San Francisco Mts. 9,500', meadow malaise, 18-24-VII-1979, S. & J. Peck (GUE). Colorado: 2 ♀♀, Steamboat Springs, 25-VII-1950, Bryant lot (CNC); 1 ♂, El Paso Co., Pikes Peak Rd., 8,500', 22-27-VII-1977, S. Peck (GUE). Iowa: 1 ♀, Ames, 14-IV-1941, D. T. Jones (USNM). Minnesota: 1 ♀, Pine Co., Mouth Snake River, 19-V-1954 (USNM); 1 ♀, Rice Co., Nerstrand Woods, 12-V-1951 (USNM); 1 ♀, Hennipin Co., 9 Mile Creek, 1-V-1937, D. Deeming (USNM); 1 ♀, Clearwater Co., Itasca St. Pk., decid. forest, on carrion, 28-29-VIII-1979, S. & J. Peck (GUE). New Jersey: 1 ♀, North Dakota: 2 ♂♂, Billings Co., Medora, Theodore Roosevelt Nat'l. Park, sage grassland, on carrion, 27-VIII-1979, S. & J. Peck (GUE). Utah: 10 ♂♂, 3 ♀♀, Uinta Co., 8 mi SE Evanston, 7,100', sage-grass riparian, on carrion, 30-VII-11-VIII-1979 (GUE); 1 ♀, Duchesne Co., Mirror Lk., spruce-fir meadow, carrion-malaise, 10,300', 12-VII-1979, S. & J. Peck (GUE); 1 ♀, Daggett Co., Dutch John, 6,300', pinyon juniper, on carrion, 2-8-VIII-1979, S. & J. Peck (GUE); 1 ♀, Summit Co., Henry's Fork Camp, 9,600', pine-aspen at stream willows, carrion malaise, 1-10-VIII-1979, S. & J. Peck (GUE); 1 ♀, Summit Co., NW side Gilbert Peak, 11,500-12,500', tundra, on carrion, 1-10-VIII-1979, S. & J. Peck (GUE). South Dakota: 2 ♀♀, Canton, 15-VI-1924 (USNM). Wyoming: 2 ♂♂, Teton Co., Moran Jct., 6,800', sage steppe, on carrion, 12-24-VIII-1979, S. & J. Peck (GUE); 1 ♂, Uinta Co., 6 mi E Mt. View, sagebrush, 1-11-VIII-79, S. & J. Peck (GUE).

Remarks. Duda proposed *micropyga* as a new name for *denticulata* Stenhammar, which he considered a homonym of *denticulata* Meigen. In fact, this is not a new name but a new species that Stenhammar had misidentified as *denticulata* Meigen. As expected, Dr. H. Schumann found no specimens labelled as types in Duda's collection in the ZMHU. We assume that those he found with Duda's handwritten determination labels are the specimens Duda (1938) examined when he described this species. Under this assumption, we have designated a lectotype and two paralectotypes.

Distribution. Holarctic.

Ischiolepta nitida (Duda)

(Fig. 80-89)

Sphaerocera nitida Duda 1920: 27; 1938: 31; Richards 1930: 318.

Ischiolepta nitida; Roháček 1978: 244; Papp 1984: 70; Florén 1989: 3.

Ischiolepta denticulata; Pitkin 1988: 34 (misidentification).

Diagnosis. *Ischiolepta nitida* is distinguishable from other species of *Ischiolepta* by the following combination of characters: legs much paler than thoracic pleura, body shiny, and male hind femur with small tubercle ventrally on basal ¼ (Fig. 84).

Description. Body shiny, blackish brown to black; 2.4-2.9 mm long.

Male. Head (Fig. 80 and 81). Black or blackish brown, shiny or subshiny; lunule yellowish brown, large, triangular; inner vertical seta short, reaching halfway to ocellar triangle; outer vertical, fronto-orbital setae as long as inner vertical seta; outer vertical seta not on distinct tubercle; postocular setae not on distinct tubercles; epistoma blackish brown, granulated; clypeus blackish brown, moderately pollinose on upper ⅔, about 1.7 times as wide as long; gena shiny brown; facial ridge with few hairlike setae; thick vibrissa and 3 long, hairlike subvibrissal setae present; eye more or less round in lateral view with longest diameter about same as genal height. **Thorax.** Black, shiny; setae on weak tubercles or not on tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them shiny; scutellum black, twice as wide as long, with 8-9 marginal tubercles; katapisternum with few hairs ventrally. **Legs.** Light to dark brown, contrasting with dark thoracic pleura; fore and hind femur almost 1.5 times as thick as middle femur; hind femur with small ventral tubercle on basal ¼ (Fig. 84); hind tibia with strong, dark brown apicoventral spur. **Wings.** Membrane hyaline; veins brown; halter pale brown. **Abdomen** (Fig. 82 and 83). Black, dull to subshiny; sternite 2 slightly larger than sternite 3 and sternite 4; sternite 5 quite shorter than other 3 preabdominal sternites; genitalia (Fig. 85 and 86) with small paramere; surstylus short with

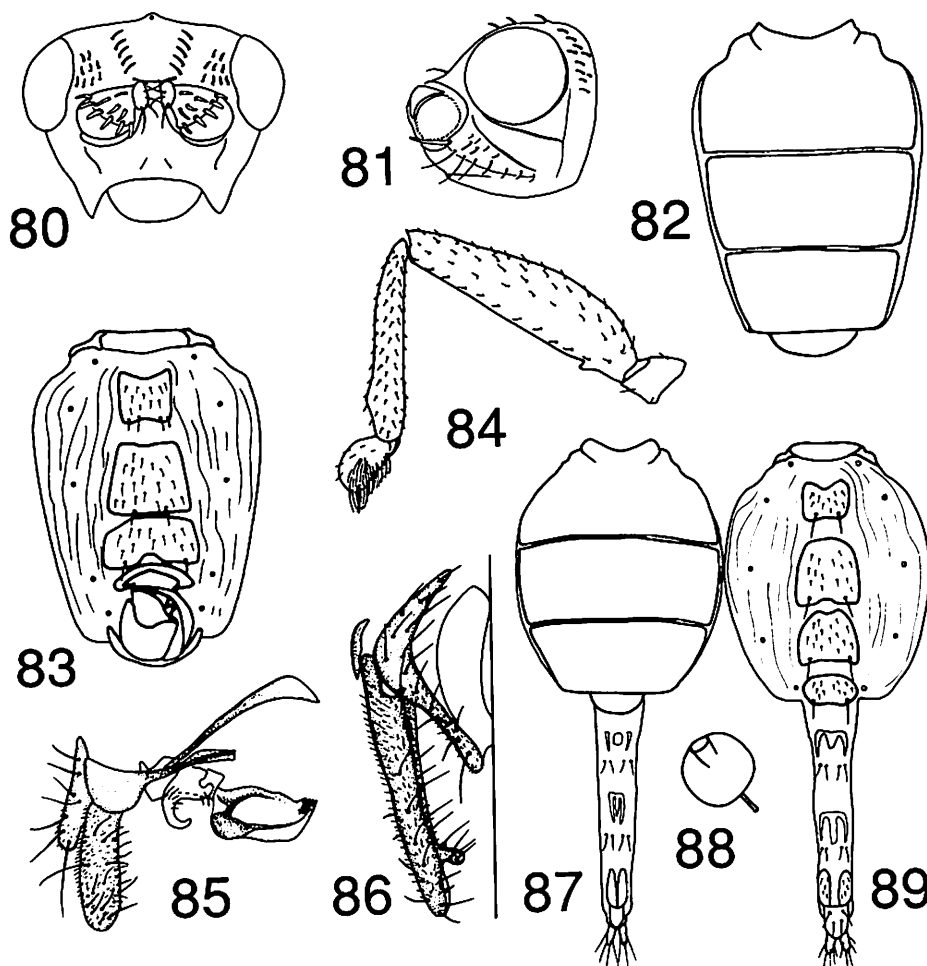


Fig. 80-89. *Ischiolepta nitida*. (80) Male: head, frontal view. (81) Male: head, lateral view. (82) Male: abdomen, dorsal view. (83) Male: abdomen, ventral view. (84) Male: hindleg (four distal tarsal segment removed). (85) Male: genitalia, lateral view. (86) Male: genitalia, caudal view. (87) Female: abdomen, dorsal view. (88) Spermatheca. (89) Female: abdomen, ventral view.

apex rounded in lateral view, inner side with distinct process near apex; basiphallus subequal to distiphallus; distiphallus with few upward projecting teeth apically, dorsal and ventral sclerites largely reduced.

Female. Head, Thorax, Wings. As in male. **Legs.** Femur not thickened; hind femur without ventral tubercle. **Abdomen** (Fig. 87-89). Sternite 2 and sternite 5 equal in size; sternite 3 and sternite 4 twice as large as sternite 2; tergite 1+2, tergite 3, and tergite 4 equal in size; tergite 5 small, entire; postabdomen largely membranous.

Type Material. LECTOTYPE (here designated, labelled by Kim in 1966): ♂, Herten, Westfalen, Germany, 1-VIII-1918, O. Duda (ZMHU). PARALLECTOTYPES (all Germany, all ZMHU): 1 ♂, Herten, Westfalen, 13-IV-1916, Duda; 1 ♂, Herten, Westfalen, 5-VI-1918, Duda; 1 ♂, Ilfeld, S. Harz Mts., 23-VI-1915, Duda; Ilfeld, S. Harz Mts., 13-

IV-1915, Duda; 1 ♀, St. Wendel, Rheinland, Duda; 1 ♀, 5-V-1918, Duda.

Other Material Examined. GERMANY: 1 ♂, Wustung b. Halbelschwerdt, 7-VII-1921, Duda (USNM); 1 ♀, Wustung b. Halbelschwerdt, 31-V-1921, Duda (USNM); 1 ♀, St. Wendel, Rheinland, 5-X-1911, Duda (USNM). IRELAND: 1 ♂, 20-II-1882, Haliday (NCID). ENGLAND: 3 ♂♂, Oxford, 15-IV-1953, J. R. Vockeroth (CNC); 1 ♂, Oxon, Nuneham, Courtney, 27-IV-1963, J.M.N. (BMNH); 1 ♂, 1 ♀, Oxon, Kidlington, 21-V-1926 (BMNH). FINLAND: 1 ♂, Karislojo, W. Hackman (ZMH); 1 ♀, Kyrkslatt, R. Frey (ZMH). SWEDEN: 1 ♂, 1 ♀, Scania, Boheman (NRS); 4 ♂, 1 ♀, Scania Roth, (NRS); 1 ♀, Vastergotland, Boheman (NRS); 1 ♀, Stockholm, Boheman (NRS); 1 ♀, Uppsala, 16-V-1932, Hedgon (NRS); 1 ♂, 1 ♀, Juntland, 1840, Zetterstedt (NRS); 1 ♂, z-d, 4-IV, Zetterstedt (NRS); 1 ♂, Lhn, 15-IV, Zetterstedt (NRS).

Distribution. Europe: England, Germany, Ireland, Scandinavia, Sweden (Florén 1989).

***Ischiolepta oedopoda* Papp**
(Fig. 90–98)

Ischiolepta oedopoda Papp 1972: 469–470; 1973b: 372–373; 1978: 392; 1984: 70; Roháček & Papp 1984: 478.

Diagnosis. *Ischiolepta oedopoda* appears closely related to *I. horrida* and *I. longispina*, which also have an extensively granulated genal area. The *I. oedopoda* male is readily distinguished from related species by the long regular pile of golden hairs on the ventrolateral side of the katapisternum. The female is distinguishable by having the abdominal sternite 5 entire and the scutellum with fewer than 10 marginal scutellar tubercles.

Description. Entirely black to dark brown; 2.13 mm long.

Male. Head (Fig. 90 and 91). Entirely black except dark brown facial carina; lunule black, triangular; inner vertical seta short, reaching halfway to ocellar triangle; outer vertical seta, fronto-orbital setae as long as inner vertical seta; outer vertical seta on very weak tubercle; postocular setae not on tubercles; epistoma black, granulated; clypeus black, 1.5 times as wide as long; gena black; supragena, infragena, and facial ridge extensively granulated; facial ridge with thick, flattened vibrissa, 4 long, hairlike subvibrissal setae, short, sparse, hairlike setae; eye more or less round in lateral view. **Thorax.** black, subshiny; most setae on weak tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them subshiny, slightly pollinose; scutellum twice as wide as long with 8 marginal tubercles; ventrolateral area of katapisternum with dense regular pile of long, golden hairs. **Legs.** Almost colorless with thoracic pleura; fore coxa with dense, long, golden hairs posteriorly; middle coxa with same type of dense hairs anteriorly; fore femur and hind femur strongly thickened, twice as thick as middle femur; fore tibia ventrally concave; hind tibia with distinct apicoventral spur. **Wings.** Membrane hyaline; veins brown; halter pale brown. **Abdomen** (Fig. 92 and 93). Tergite 3 and tergite 4 equal in length, subequal to tergite 1+2 in length; tergite 5 about half as long as tergite 4; sternite 3 and sternite 4 approximately equal in size; sternite 2 about 0.7 times as long as sternite 3; sternite 5 much narrower than other preabdominal sternites; genitalia (Fig. 97 and 98) with surstylus parallel-sided in lateral view with round apex; paramere large with rather small frontal process; distiphallus with long apical process; dorsal sclerite ending with 3 hooklike processes on each side of distiphallus.

Female. Head, Wings. As in male. **Legs, Thorax.** Generally similar to those of male except: femur

not thickened; hairs on fore and hind coxa and katapisternum rather sparse and irregular as in other species of *Ischiolepta*. **Abdomen** (Fig. 94–96). Tergite 1+2, tergite 3, and tergite 4 about equal in length; tergite 5 smallest, entire; sternite 1 represented by 2 small round sclerites; sternite 2 more or less rectangular, gently rounded on corners; sternite 3 about 1.5 times as long as sternite 2; sternite 4 subequal to sternite 3; sternite 5 as wide as sternite 4 but short; postabdomen largely membranous.

Type Material. HOLOTYPE: ♂, Csévhaszt, Com. Pest, Hungary, 12-V-1969, L. Papp (HNHM).

Other Material Examined. MONGOLIA: 1 ♂, 1 ♀, Dasinesilen, 2-VIII-1971, Somogyi P. (HNHM); 1 ♂, Cecerleg, 25-VIII-1971, Somogyi P. (HNHM).

Distribution. Palearctic: known from Hungary, Mongolia, Caucasus (USSR), and North Korea (Papp 1978).

***Ischiolepta orientalis* (de Meijere)**
(Fig. 99–107)

Sphaerocera orientalis Meijere 1908: 178–179.

Ischiolepta orientalis; Hackman 1977: 399; Roháček & Papp 1984: 474–476; Papp 1988: 466.

Diagnosis. *Ischiolepta orientalis* is closely related to *I. draskovitsae*, which shares the following synapomorphies: epistoma and clypeus yellow, contrasting with dark frons; inner vertical seta long, reaching ocellar triangle. The male is distinguishable from others by the following characters: hind femur slightly thicker than fore femur, apex of surstylus boot-shaped. The female of *draskovitsae* is unknown.

Description. Body brown to dark brown, subshiny; 1.8–2.0 mm long.

Male. Head (Fig. 99 and 100). Dark brown except brownish yellow epistoma and clypeus; lunule dark brown, large, triangular; inner vertical seta as long as vibrissa, inclined, reaching ocellar triangle; outer vertical seta half as long as inner vertical seta, on weak tubercle; fronto-orbital setae as long as outer vertical seta; postocular setae not on tubercles; epistoma granulated; clypeus about twice as wide as long; gena dark brown, shiny; facial ridge with dense, short, hairlike setae, thick, flattened vibrissa, and 4 long, hairlike subvibrissal setae; eye more or less round in lateral view. **Thorax.** Dark brown, subshiny; most setae on weak tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them subshiny, slightly pollinose; scutellum dark brown with 8 marginal scutellar tubercles; katapisternum with only a few long hairs ventrolaterally. **Legs.** Brownish yellow, contrasting with dark brown thoracic pleura; fore and hind femora about 1.5 times as thick as middle femur; hind tibia with distinct apicoventral spur. **Wings.** Membrane hyaline; veins brown; halter pale brown. **Abdomen** (Fig. 101 and

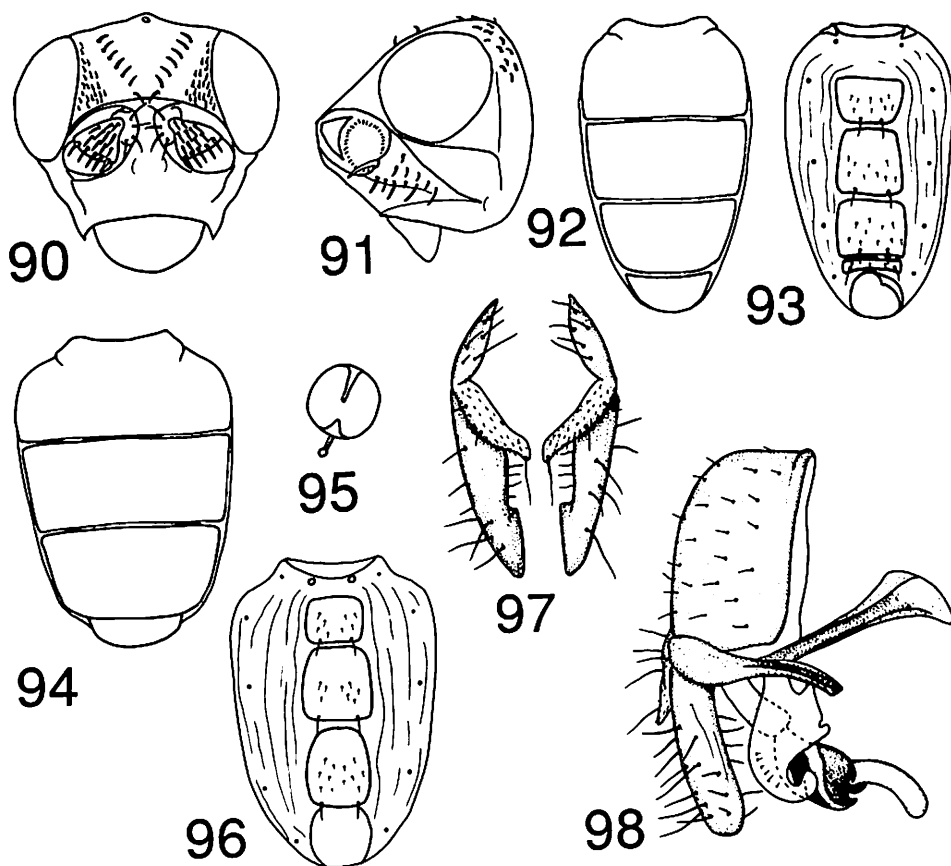


Fig. 90–98. *Ischiolepta oedopoda*. (90) Male: head, frontal view. (91) Male: head, lateral view. (92) Male: abdomen, dorsal view. (93) Male: abdomen, ventral view. (94) Female preabdomen, dorsal. (95) Spermatheca. (96) Female: preabdomen, ventral view. (97) Male: genitalia, caudal view. (98) Male: genitalia, lateral view.

102). Broad, slightly tapered posteriorly; tergite 1+2 slightly longer than tergite 3; tergite 3 and tergite 4 equal in length; tergite 5 smallest, entire; preabdominal sternites very small; sternite 2 and sternite 3 more or less rectangular; sternite 4 and sternite 5 very short and wide; genitalia (Fig. 106 and 107) with surstylus long, slender, slightly bent apically, appearing boot-shaped; paramere with long, slender posterior process, long and very thick anterior process; distiphallus with 1 pair of long frontal processes; dorsal sclerite with 2 pairs of upwardly directed hooks.

Female. *Head, Thorax.* As in male. *Abdomen* (Fig. 103–105). Tapered posteriorly; tergite 1+2 slightly longer than tergite 3; tergite 4 as long as tergite 3; tergite 5 very small but entire; preabdominal sternites very small, about equal in size; postabdomen largely membranous.

Type Material. HOLOTYPE: ♀, Semarang, Java, Jacobson (ITZA) (with label stating "Type"). Although de Meijere did not designate a primary type, we have decided it is the holotype of this species because the original description was based on a single specimen.

Other Material Examined. SRI LANKA: 1 ♂, 1 ♀, Centr. Prov., Rambukpath Oya, 10 mi NW Hattton, 18-III-1962, Brinck, Anderson & Cederholm, at light (HNHM). VIETNAM: 1 ♂, Hanoi, 4-XI-1964, Hanninger (HNHM).

Distribution. Eastern Palearctic and Oriental: known from Indonesia, India, Vietnam, Sri Lanka, and Japan (Roháček & Papp 1984).

Ischiolepta pansa Han and Kim, sp. n.
(Fig. 108–116)

Lotobia scabricula; Vanschuytbroeck (*partim*)
1948: 20; 1959b: 26–27 (misidentification).

Diagnosis. *Ischiolepta pansa* is closely related to *I. stuarti*, which also has 2 distinct calli on anterior portion of scutum. It is distinguishable from *I. stuarti* by having 7 dark, blunt, marginal scutellar tubercles (Fig. 112). It differs from *I. vanschuytbroeckii* by having the scutellum wider (2.5 times as wide as long) and male sternite 5 entire.

Description. Body subshiny, brown to dark brown; 1.9–2.0 mm long.

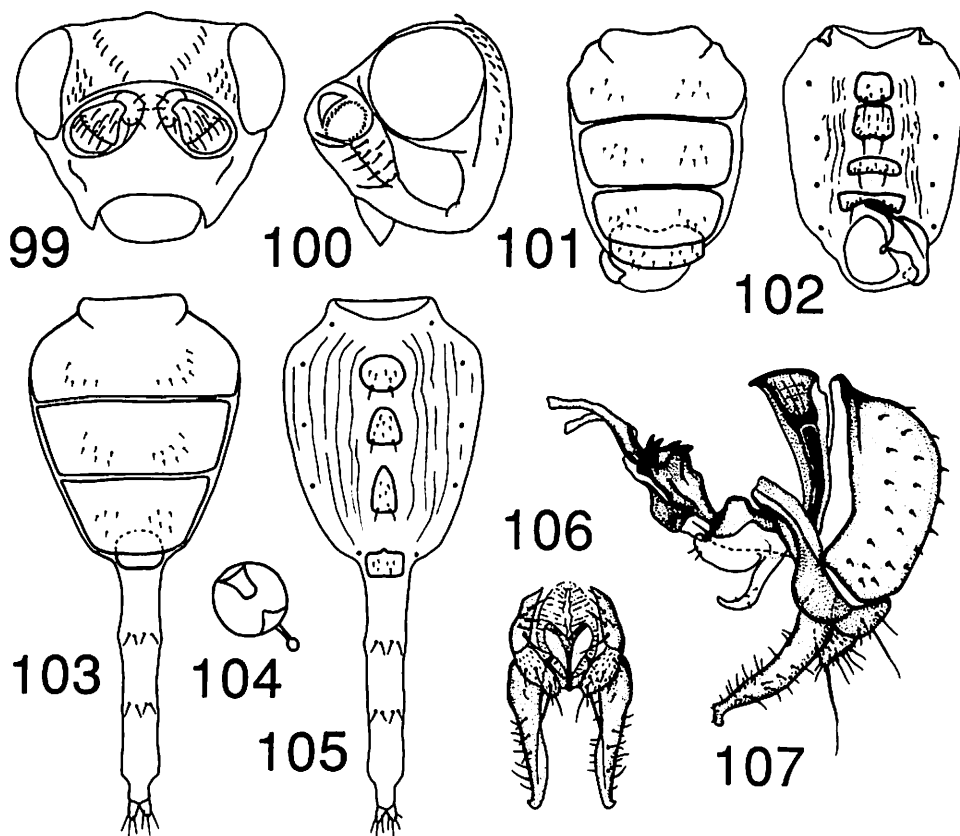


Fig. 99–107. *Ischiolepta orientalis*. (99) Male: head, frontal view. (100) Male: head, lateral view. (101) Male: abdomen, dorsal view (after Roháček & Papp 1984). (102) Male: abdomen, ventral view (after Roháček & Papp 1984). (103) Female: abdomen, dorsal view. (104) Spermatheca. (105) Female: abdomen, ventral view. (106) Male genitalia, caudal view (after Roháček & Papp 1984). (107) Male: genitalia, lateral view (after Roháček & Papp 1984).

Male. Head (Fig. 108 and 109). Subshiny, brown; lunule brown, triangular; inner vertical seta indistinguishable; outer vertical setae long, on extremely large tubercle; 2 fronto-orbital setae as long as outer vertical setae; postocular setae small, on weak tubercles; epistoma flattened, brown, granulated; clypeus brown, about 1.7 times as wide as long; gena brown, smooth; vibrissa thick, as long as pedicel; facial ridge with dense, short, blunt setae and 1–2 subvibrissal setae; eye more or less elliptic in lateral view with longest diameter about same as genal height. **Thorax**. Dark brown, subshiny, most setae on strong tubercles; postpronotal lobe yellowish brown, contrasting with dark scutum; anterior portion of scutum with distinct callus anterior to each row of dorsocentral setae; acrostichal setae in 2 rows on anterior half of presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae; 2 notopleural setae as long as outer vertical setae with hind one on large tubercle; postalar seta on thick, spinelike tubercle; scutellum about 2.5 times as wide as long with 7 long and thick marginal tubercles (Fig. 112); katapisternum

with only few hairs ventrolaterally. **Legs**. Short and slender, yellowish brown, contrasting with dark thoracic pleura; all femora about same in thickness; hind tibia with black, strong apicoventral spur. **Wings**. Membrane hyaline; veins brown; halter pale yellow. **Abdomen** (Fig. 110 and 111). Tergite 1+2 about 1.5 times as long as tergite 3; tergite 3 as long as tergite 4; tergite 5 divided into 2 more or less round sclerites; sternite 3 slightly longer than sternite 2; sternite 4 half as long as sternite 3; sternite 5 short, entire; genitalia (Fig. 113 and 114) with surstylus long, straight, with slightly bifurcate apex; paramere long with short anterior process; distiphallus large with broad apical process; ejaculatory duct visible in lateral view.

Female. Head, Thorax, Legs, Wings. As in male. **Abdomen** (Fig. 115 and 116). Tergite 1+2, tergite 3, tergite 4 about equal in length; tergite 5 small, incompletely divided posteriorly; sternite 3, sternite 4 about twice as long as sternite 2; sternite 5 small, entire; postabdomen membranous.

Type Material. HOLOTYPE: ♂, Kivu Rutshuru, Congo Belge (Zaire), 1,285 m, 2-VII-1935, G. F.

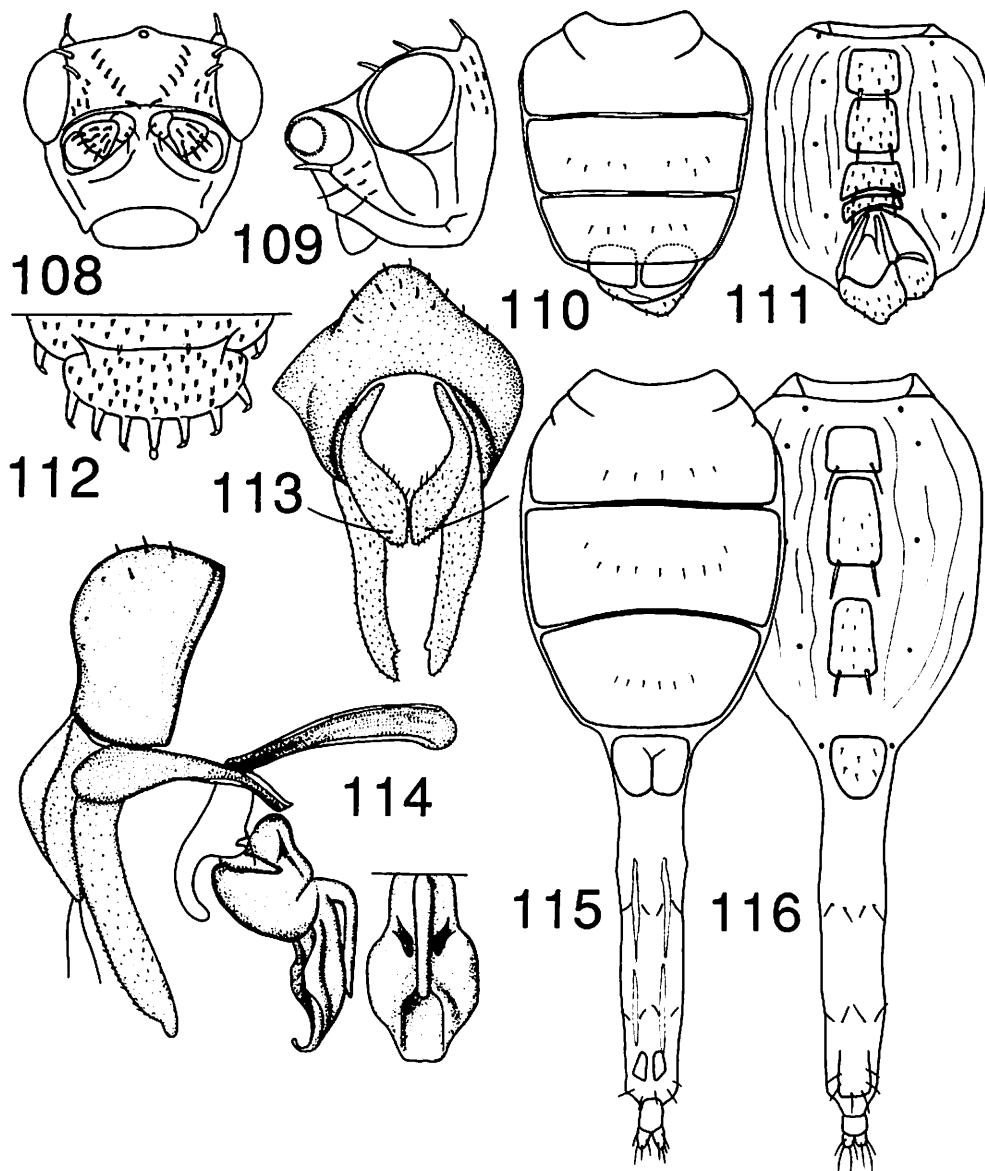


Fig. 108–116. *Ischiolepta pansa*. (108) Male: head, frontal view. (109) Male: head, lateral view. (110) Male: abdomen, dorsal view. (111) Male: abdomen, ventral view. (112) Scutellum, dorsal view. (113) Male: genitalia, caudal view. (114) Male: genitalia, lateral view; distiphallus, frontal view. (115) Female: abdomen, dorsal view. (116) Female: abdomen, ventral view.

de Witte (IRSN). PARATYPES (all Congo Belge, all IRSN): 2 ♂♂, same data as holotype; 1 ♀, same data except 8-VI-1935; 1 ♀, same data except 5-VII-1935; 1 ♀, same data except 6-VII-1935; 1 ♀, Park National Albert, Burunga (Mokoto), 2,000 m, 19-III-1934, G. F. de Witte.

Distribution. Known only from Zaire.

Etymology. The specific epithet is derived from the Latin *pansus*, meaning spread or extended, referring to the extended apical process of the distiphallus.

***Ischiolepta pusilla* (Fallén)**
(Fig. 1–4, 117–125)

Copromyza pusilla Fallén 1820: 8; Zetterstedt 1847: 2490–2491.

Sphaerocera pusilla; Stenhammar 1855: 435–438; Schiner 1864: 326; Howard 1900: 596; Becker (*partim*) 1905: 29; Duda 1920: 29; 1938: 33; Spuler 1924: 69; Malloch 1925: 122; Richards 1930: 318; 1965a: 719; 1973: 302; Séguy 1934: 453–454; Harrison 1959: 258.

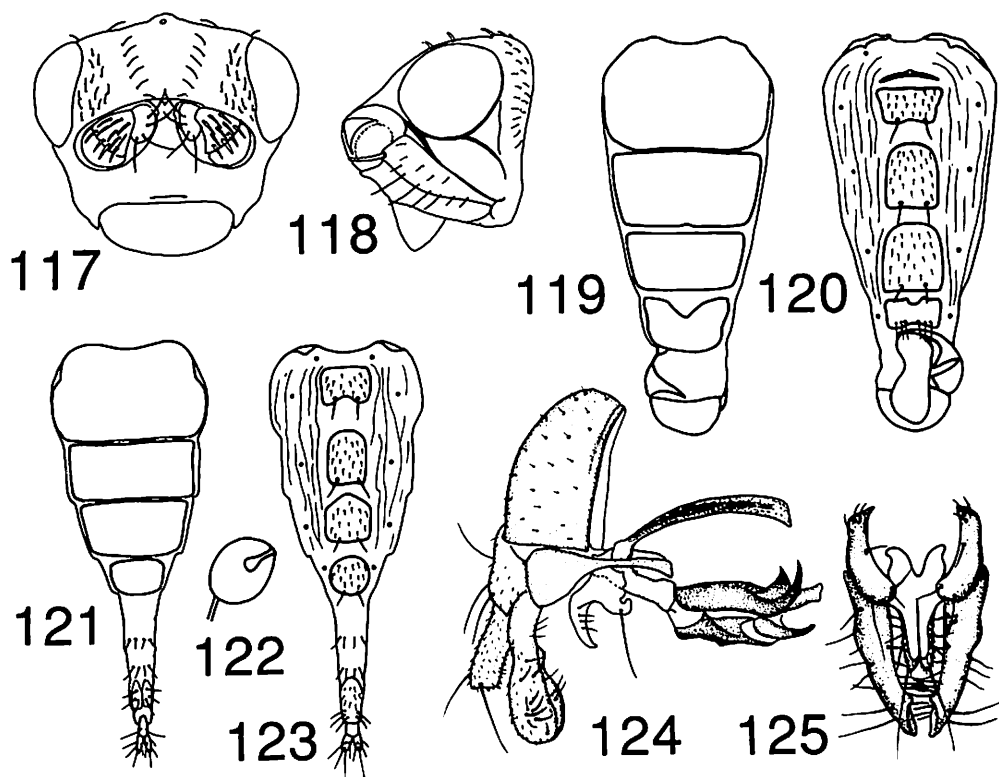


Fig. 117–125. *Ischiolepta pusilla*. (117) Male: head, frontal view. (118) Male: head, lateral view. (119) Male: abdomen, dorsal view. (120) Male: abdomen, ventral view. (121) Female: abdomen, dorsal view. (122) Spermatheca. (123) Female: abdomen, ventral view. (124) Male: genitalia, lateral view. (125) Male: genitalia, caudal view.

Sphaerocera nigripes Strobl 1900: 68; Duda 1938: 32 (as var. of *pusilla*).

Sphaerocera denticulata; Haliday 1836: 320 (*vide* Collin 1914); Collin 1914: 236 (misidentification).

Sphaerocera margaritata Becker 1907: 376–377, 386; Duda 1938: 33.

Sphaerocera parapusilla Duda (*partim*) 1920: 32; Duda 1938: 32.

Ischiolepta pusilla; Kim 1972a: 205; Papp 1973a: 358; 1978: 392; 1984: 71; Roháček 1978: 244; Hackman 1980: 147; Nishijima & Yamazaki 1984: 86–87; Roháček & Papp 1984: 478; Pitkin 1988: 34; Florén 1989: 4.

Diagnosis. *Ischiolepta pusilla* is very similar to *I. vaporariorum* and can be distinguished only by the following male genitalic characters (Fig. 124 and 125): cerci projecting ventrally; dorsal sclerite of distiphallus with upcurved apical process. Two forms of hind femora occur in the male: thick and slender.

Description. Body black, dull species, 2.2–2.4 mm long.

Male. Head (Fig. 117 and 118). Black, subshiny; lunule black, small, crescentic; inner and outer vertical setae, 2 fronto-orbital setae small but distinct,

about same in length; outer vertical seta on very weak tubercle; epistoma blackish brown, granulated; clypeus about 1.5 times as wide as long, pollinose except on lower margin; gena dark brown, shiny; facial ridge with thick vibrissa, 3–4 long, hairlike subvibrissal setae, and sparse, short, hairlike setae; eye more or less elliptic in lateral view. **Thorax.** Black, dull; most setae on weak tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them moderately pollinose; scutellum black, subshiny, twice as wide as long with 7–10 marginal tubercles; katepisternum with sparse hairs ventrolaterally. **Legs.** Yellowish brown, contrasting with dark thoracic pleura; tibia darker than femora; thickness of hind femur polymorphic, strongly thickened or slender; hind tibia with strong apicoventral setae. **Wings.** Membrane grayish; veins brown; halter pale brown. **Abdomen** (Fig. 119 and 120). Dark brown, rather narrow; tergite 1+2 about 1.5 times as long as tergite 3; tergite 4 equal to tergite 3 in length; tergite 5 entire, notched anteriorly; 4 preabdominal sternites distinct, more or less rectangular, sternite 5 with 6 or more setae on posterior margin; genitalia (Fig. 124 and 125) with small, sickle-

shaped paramere; surstylus long, apex rounded in lateral view; cerci distinctly developed, projecting downward to approximately basal 1/2 of surstylus; basiphallus much shorter than distiphallus; distiphallus with tubelike apical process, dorsal sclerite with a pair of upcurved apical process, ventral sclerite with straight-pointed process apically.

Female. Head, Thorax, Wings. As in male. **Legs.** Femur not thickened. **Abdomen** (Fig. 121-123). Tergite 1+2 slightly shorter than tergite 3 and 4 combined; tergite 5 round, entire; sternite 2, sternite 3, sternite 4 equal in size, more or less rectangular; sternite 5 round; postabdomen membranous.

Type Material. LECTOTYPE (here designated; labelled by Kim in 1963): 1 ♀ and 3 PARALECTOTYPE ♀♀, Sweden (Kim 1972a) (SMNH); no additional collection data. Although they are all females, the lectotype and one paralectotype have Fallén's hand-written label "*Copromyza pusilla*, male"; the other two paralectotypes have Fallén's labels stating "*Copromyza pusilla*, female."

Other Material Examined. Approximately 600 specimens from Australia, Austria, Canada, Denmark, Poland, E. Germany, England, Finland, Iceland, New Zealand, Spain, Sweden, United States, and Federal Republic of Germany. They are almost always present in the collections of the museums and institutions listed in the Materials and Methods section.

Distribution. Holarctic, Australia, Argentina, and North Africa (Papp 1978).

Remarks. Pitkin (1988) indicated that *I. pusilla* was polymorphic in the thickness of the hind femur. He sent us 17 male British specimens, of which seven have strongly thickened hind femora and 10 slender hind femora.

***Ischiolepta scabra* (Spuler), n. comb.**
(Fig. 126-134)

Sphaerocera scabra Spuler 1924: 68-69; Malloch 1925: 119, 122; Richards 1965a: 719.

Diagnosis. *Ischiolepta scabra* is closely related to *I. denticulata* and *I. intermedia*, which also have a dish-shaped ventral process on the distiphallus. It is distinguishable from *denticulata* by having a small paramere in the male (Fig. 130) and an entire abdominal sternite 5 in the female (Fig. 134). The *I. scabra* male can be readily distinguished by having abdominal tergite 5 divided into 2 round sclerites (Fig. 128). The *I. scabra* female is very difficult to differentiate from the female of *I. intermedia*, but the following characters provide a limited means of separation: abdominal sternite 5 peanut-shaped (Fig. 134), abdomen oval in dorsal view (Fig. 132).

Description. Entirely black, opaque, dull to subshiny species, 3.3-3.5 mm long.

Male. Head (Fig. 126 and 127). Entirely black; lunule black, large, triangular; inner vertical seta short, reaching halfway to ocellar triangle; 2 fronto-

orbital setae and outer vertical seta as long as inner vertical seta; outer vertical setae on distinct tubercle; postocular setae on small tubercle; epistoma blackish brown, granulated; clypeus black, pollinose except lower margin, about twice as wide as long; gena black shiny; facial ridge with thick vibrissa, 3-4 long subvibrissal setae, numerous small, blunt setae on distinct tubercles; eye more or less elliptic in lateral view. **Thorax.** Black, dull; most setae on strong tubercles, or setae usually shorter than tubercles; acrostichal setae in 2 rows on anterior half to 1/3 of presutural area of scutum and in 4 irregular rows posteriorly; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them moderately pollinose; scutellum black, subshiny, twice as wide as long, with 8 strong marginal tubercles; katapisternum with few long hairs lateroventrally. **Legs.** Black, slender; fore femur slightly thicker than middle and hind femur; hind tibia with strong apicoventral spur. **Wings.** Membrane brownish; veins dark brown; halter pale brown. **Abdomen** (Fig. 128 and 129). Parallel-sided; dorsum subshiny, black; tergite 1+2 slightly longer than tergite 3; tergites 3 and 4 about same in size; tergite 5 divided into 2 elliptic sclerites; sternites 2-4 about same in size; sternite 5 narrow; genitalia (Fig. 130 and 131) very large; epandrium extremely large, occupying half length of abdomen; surstylus very long, slender, bent forward in lateral view; paramere small with anterior process half as long as posterior process; distiphallus longer than basiphallus, with apical dish-shaped process.

Female. Head, Thorax, Legs, Wings. As in male. **Abdomen** (Fig. 132-134). Tergites 1+2, 3, 4 about equal in length; tergite 5 subdivided into 2 triangular sclerites; sternite 2 small; sternite 3, sternite 4 equal in size; sternite 5 dorsoventrally constricted, peanut-shaped; postabdomen largely membranous.

Type Material. HOLOTYPE: ♂, South Bend, Washington, 23-V-1917, A. L. Melander (USNM).

Other Material Examined. CANADA: Ontario: 1 ♀, Marmora, 13-VII-1952, J. R. Vockeroth (CNC). UNITED STATES: Michigan: 2 ♂♂, Roscommon Co., 2-VI-1953, R. R. Dreisbach; 1 ♀, Missaukee Co., 23-V-1951, R. R. Dreisbach; 1 ♀, 1 ♂, Wexford Co., 14-VI-1952. Minnesota: 1 ♀, 1 ♂, Still water, ground bait trap, 13-VII-1960, Ralph Gunderson (GUE). Oregon: 1 ♀, Neskowin, 20-VIII-1948, M. T. James.

Distribution. Nearctic: Ontario and Michigan to Washington and Oregon.

***Ischiolepta scabricula* (Haliday)**
(Fig. 135-141)

Sphaerocera scabricula Haliday 1836: 320; 1839: 188; Collin 1914: 237; Villeneuve 1914: 208; Duda 1920: 34-35; 1938: 33-34; Richards 1930: 318; Séguy 1934: 454.

Sphaerocera pallidimana Rondani 1880: 17, 5 (fide Collin 1914).

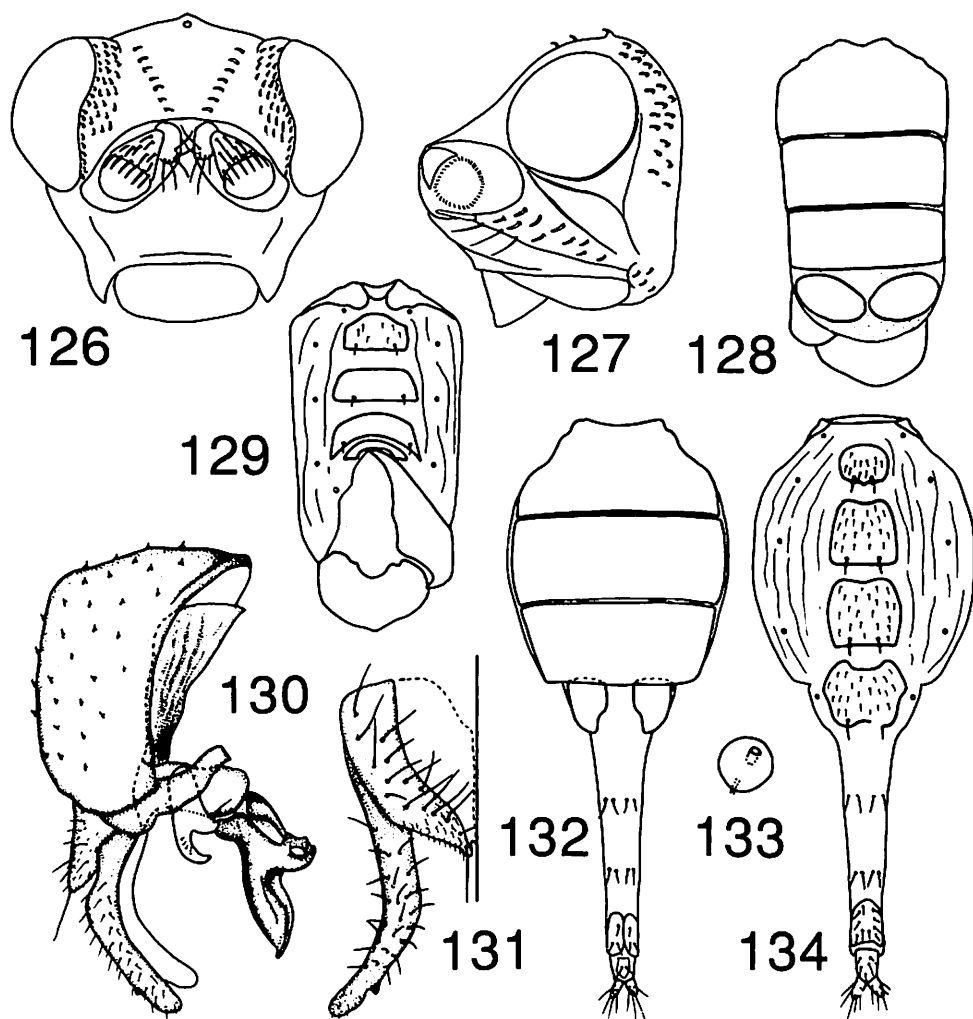


Fig. 126–134. *Ischiolepta scabra*. (126) Male: head, frontal view. (127) Male: head, lateral view. (128) Male: abdomen, dorsal view. (129) Male: abdomen, ventral view. (130) Male: genitalia, lateral view. (131) Male: genitalia, caudal view. (132) Female: abdomen, dorsal view. (133) Spermatheca. (134) Female: abdomen, ventral view.

Ischiolepta scabricula; Papp 1978: 397; 1984: 71; Hackman 1980: 147; Nishijima & Yamazaki 1984: 86; Pitkin 1988: 33; Florén 1989: 4.

Diagnosis. This species is readily distinguishable from any *Ischiolepta* species by the following characters: sparse setae on infragena (Fig. 136); acrostichal and dorsocentral setae completely diffused; eye unusually small (about 0.7 times as long as genal height).

Description. *Male*: Very small, about 1.5 mm long, black or black brown. *Head* (Fig. 135 and 136). Black, dull, densely covered with blunt, relatively long setae; frontal vitta deeply concave in center; interfrontal setae marked by distinct ridges; lunule brown, large, triangular; inner, outer, fronto-orbital and ocellar setae not distinguishable from

other setae; epistoma brown, flat or slightly concave, triangular; clypeus short, rounded apically; gena short, brown, infragena with few blunt setae; subgena very short; vibrissa as long as other setae; subvibrissal setae not easily distinguishable; facial ridge with numerous blunt setae; eye very small, with longest diameter about 0.7 times as long as genal height. *Thorax*. Blackish brown to brown, dull to subshiny, covered with numerous blunt setae; acrostichal and dorsocentral setae not easily distinguished; pair of prescutellar setae distinct; scutellum 3 times as wide as long, brown to black brown, with 8–9 marginal tubercles, each with large, blunt setae (Fig. 139). *Legs*. Brown to dark brown, short, slender. *Wings*. Membrane hyaline; veins brown; costal setae spinelike; halter pale. *Abdomen* (Fig. 137 and 138). Tergite 1+2 slightly shorter

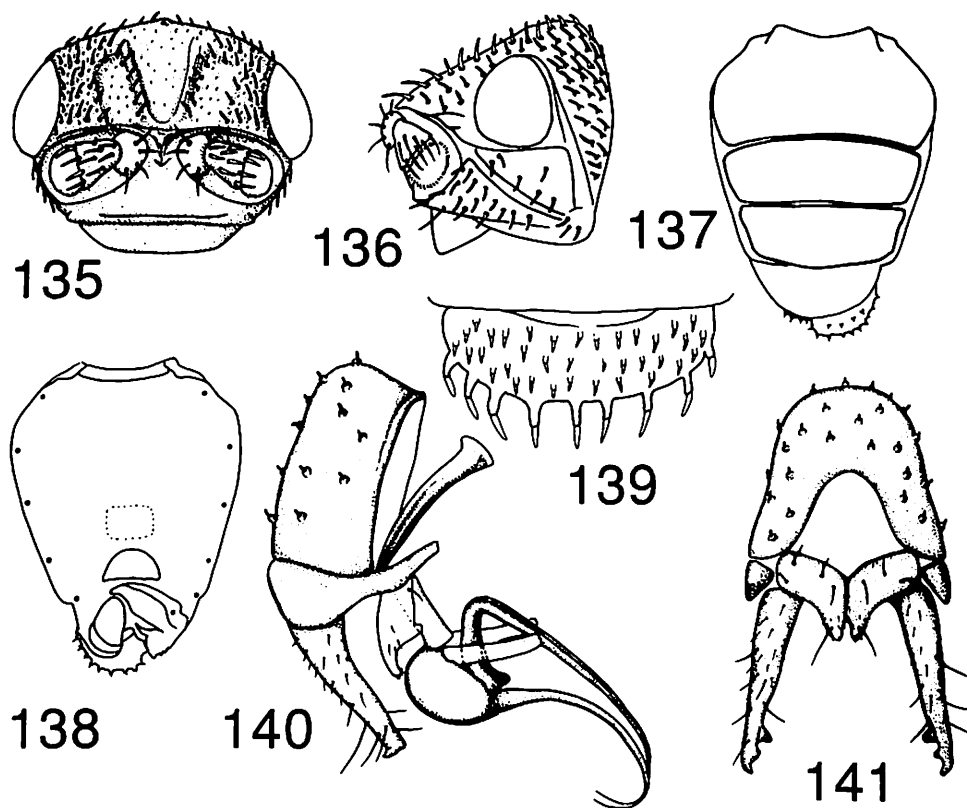


Fig. 135–141. *Ischiolepta scabricula*, Male. (135) Head, frontal view. (136) Head, lateral view. (137) Abdomen, dorsal view. (138) Abdomen, ventral view. (139) Scutellum, dorsal view. (140) Genitalia, lateral view. (141) Genitalia, caudal view.

than tergite 3 and tergite 4 combined; sternite 2, sternite 3, and sternite 4 reduced; epandrium with setae on distinct tubercles; genitalia (Fig. 140 and 141) with cerci fused medially; surstylus long and slender, inner side with 2 strong tubercles subapically; paramere half as long as surstylus with small anterior process; distiphallus with long down-curved ejaculatory duct; ejaculatory duct supported by pair of lateral arms and long, slender apical process; ventral sclerite of distiphallus round and smooth.

Female. Not examined.

Type Material. LECTOTYPE ♂ and PARALECTOTYPE ♂ (here designated, labeled in 1988) (MVA; Curtis Collection). They are unlabeled, except the lectotype bears a dark green label stating “scabricula” in Haliday’s writing. Both are mounted like typical Haliday specimens, with the venter glued to rectangular cards and the wings and legs spread.

Other Material Examined. IRELAND: 5 ♂♂, 20-II-1882 (not collection date; Norrbom [1986, 47]), Haliday (NCID). GERMANY: 1 ♂, Lineberg, Heide, Kohlembressen, 30-VI-1960, J. C. Deeming (ZMHU).

Remarks. According to Haliday, the unspecified number of syntypes was collected “near London

by Mr. Walker.” Collin (1914) said there were two syntypes in NCID, but there are five male specimens that have Haliday collection labels. All of them also have light green, machine-printed “Ireland” labels and were determined by Collin. Two similarly mounted males also are present in the MVA. One of these does not have a label, and the other states (in Haliday’s handwriting) “scabricula” on a dark green label, which normally indicates that specimens were from Ireland (Norrbom 1986, O’Connor & Nash 1982). Therefore, we believe the syntypes could have been either mislabelled or lost. Under these circumstances, we designate the specimen determined by Haliday as a lectotype.

Distribution. India, Tanzania, Ghana, Afghanistan, Hungary (Papp 1978), Finland (Hackman 1980), England (Pitkin 1988), Germany, Ireland.

Ischiolepta stuarti Han and Kim, sp. n.
(Fig. 142–151)

Lotobia scabricula; Vanschuytbroeck (*partim*)
1948: 20; 1959b: 26–27 (misidentification).

Diagnosis. *Ischiolepta stuarti* is closely related to *I. pansa*, which also has 2 distinct calli on the

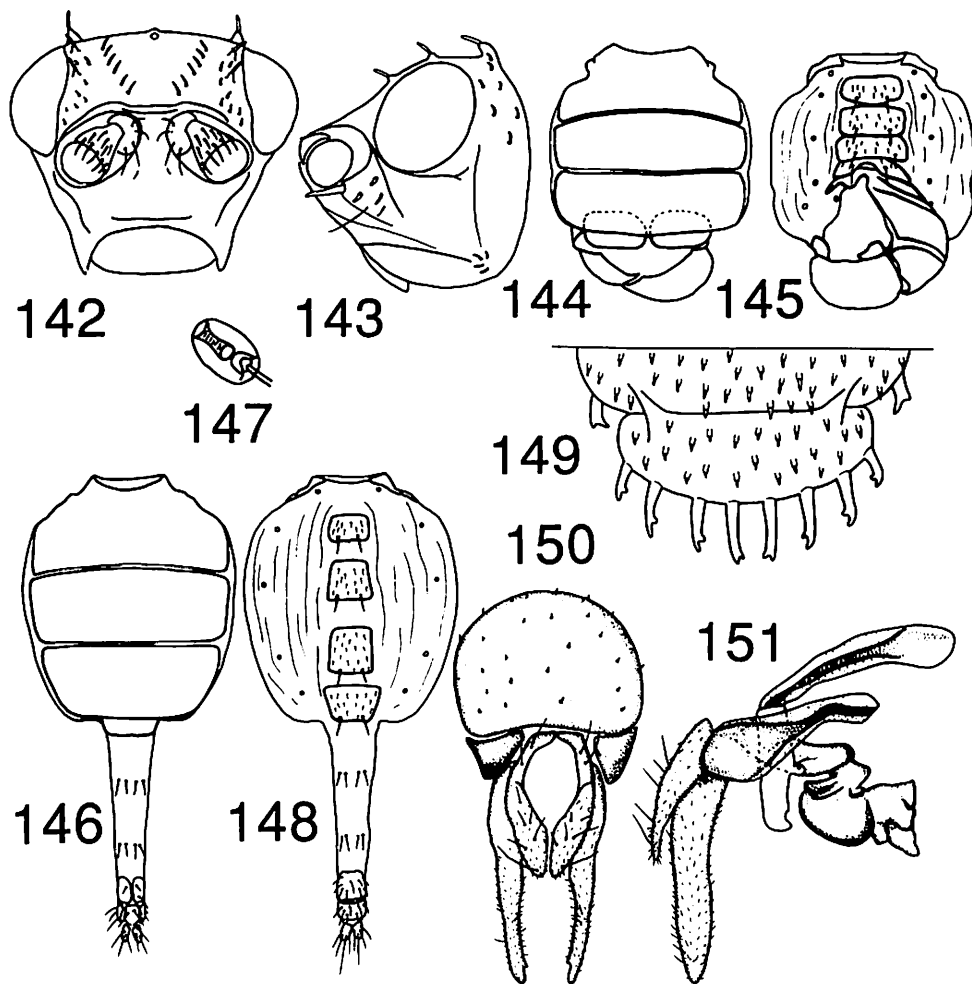


Fig. 142-151. *Ischiolepta stuarti*. (142) Male: head, frontal view. (143) Male: head, lateral view. (144) Male: abdomen, dorsal view. (145) Male: abdomen, ventral view. (146) Female: abdomen, dorsal view. (147) Spermatheca. (148) Female: abdomen, ventral view. (149) Scutellum, dorsal view. (150) Male: genitalia, caudal view. (151) Male: genitalia, lateral view.

anterior portion of the scutum, but *I. stuarti* is readily distinguishable from other species of *Ischiolepta* by having 8 yellow, unusually long, bifurcate marginal scutellar tubercles (Fig. 149).

Description. Body shiny or subshiny, blackish brown, 2.3-2.7 mm long.

Male. Head (Fig. 142 and 143). Subshiny, brown; lunule brown, large, triangular; inner vertical seta indistinguishable; outer vertical seta long, on large tubercle; 2 fronto-orbital setae as long as outer vertical setae, on small tubercles; postocular setae small, in irregular rows; epistoma flattened, dark brown, granulated; clypeus dark brown, about 1.5 times as wide as long; gena dark brown, smooth; vibrissa thick, as long as pedicel; facial ridge with dense short blunt setae and 1-2 subvibrissal setae; eye elliptic in lateral view with longest diameter about same as genal height. **Thorax.** Dark brown, shiny or subshiny; most setae on strong tubercles, or setae

shorter than tubercles; scutum with distinct callus anterior to dorsocentral setae; acrostichal setae in 2 rows on anterior $\frac{1}{3}$ of presutural area of scutum, and in 4 irregular rows posteriorly; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them shiny; 2 notopleural setae as long as outer vertical setae, with hind one on large tubercle; postalar tubercle sharply angulated apically; scutellum (Fig. 149) about 2.5 times as wide as long, with 8 long, yellow marginal tubercles; each tubercle little shorter than scutellum, with apex distinctly bifurcate; katepisternum with only few hairlike setae lateroventrally. **Legs.** Yellowish brown, contrasting with dark thoracic pleura; fore and hind femur thickened, about 1.5 times as thick as middle femur; hind femur with basal $\frac{1}{3}$ brown, remaining $\frac{2}{3}$ dark brown; hind tibia with strong, black apicoventral spur. **Wings.** Membrane hyaline; veins brown; knob of halter white; pedicel

dark brown. *Abdomen* (Fig. 144 and 145). Black, short; tergite 1+2, 3, 4 about equal in length, tergite 5 divided into 2 elliptic sclerites; sternite 2, sternite 3, sternite 4 more or less rectangular, about equal in size; sternite 5 narrow but entire; genitalia (Fig. 150 and 151) large; surstylus long, straight with slightly bifurcate apex; paramere long with tiny frontal process; basiphallus and distiphallus equal in length; distiphallus evenly sclerotized without any process.

Female. Head, Thorax, Wings. As in male. *Legs.* Femur not thickened. *Abdomen* (Fig. 146–148). Short; tergite 1+2, tergite 3, and tergite 4 equal in size; all preabdominal sternites equal in size; postabdomen largely membranous.

Type Material. HOLOTYPE: ♂, Park National Albert, Ngarusambol (Kikere) Congo Belge (Zaire), 2,226 m, 28–29-VI-1934, G. F. de Witte (MRAC). ALLOTYPE: ♀, Mushumangabo (Volc. Nyamuragira), Congo Belge, 2,075 m, 14–26-VI-1935, G. F. de Witte (MRAC). PARATYPES (all Congo Belge): 1 ♂, Mateba, 1. G 17375, 3-II-1949, Vans (MRAC); 2 ♂♂, Park National Albert, Kanyabayonga (Kabasha), 1,760 m, 7-XII-1934, G. F. de Witte (IRSN); 2 ♂♂, Park National Albert, vers Rweru, volc. Mike-no (Bambous), 2,400 m, 3-VII-1934, G. F. de Witte (IRSN); 1 ♀, Park National Albert, Shamuheru (Volc. Nyamuragira), 1,843 m, 15-VI-1935, G. F. de Witte (IRSN); Park National Albert, Shamuheru (Volc. Nyamuragira), 1,843 m, 26-VI-1935, G. F. de Witte (IRSN); 1 ♀, Park National Albert, Shamuheru (Volc. Nyamuragira), 1,843 m, 14–26-VI-1935, G. F. de Witte (IRSN); 1 ♀, Park National Albert, Burunga (Mokoto), 2,000 m, 17–19-III-1934, G. F. de Witte (IRSN); 3 ♂♂, Kivu, Ngesho, 2,000 m, 3–6-IV-1924, G. F. de Witte (IRSN); 1 ♂, Kivu, Luofu, 1,700 m, 10-XII-1934, G. F. de Witte (IRSN); 1 ♂, Kivu, Tshumba (Mushari), 2,100 m, 28-IV-1934, G. F. de Witte (IRSN); 1 ♂, 2 ♀♀, Kivu, Kalondo (Iac Ndaraga, Mokoto), 1,750 m, 22–27-III-1934, G. F. de Witte (IRSN); 1 ♂, Raunda Ilega (pied Volc. Karisimbi), 2,400 m, 12-III-1935, G. F. de Witte (IRSN); 1 ♀, Rutshuru, 1,250 m, 6–8-VI-1934, G. F. de Witte (IRSN).

Distribution. Known only from Zaire.

Etymology. This species is named after Stuart K. Kim, the beloved son of K. C. Kim.

Ischiolepta vanschuytbroeckii Papp

Ischiolepta vanschuytbroeckii Papp 1978: 394.

Diagnosis. According to the original description and illustration (Papp 1978), this species appears closely related to *I. pansa* and *I. stuarti* but can be distinguished by having the scutellum 1.5 times as wide as long, with 7 long, thick marginal tubercles; the fore femur thickened, thickest subapically, then abruptly attenuating; and both tergite 5 and sternite 5 divided in the male.

Type Material. HOLOTYPE: ♂ Siviti, IRHO rain forest, Congo. 25-XI-1963, S. Endrödy-Younga (No. 237) (HNHM).

Material Examined. No specimens were available for study.

Distribution. Known only from Congo.

Ischiolepta vaporariorum (Haliday) (Fig. 152–160)

Sphaerocera vaporariorum Haliday 1836: 319; Walker 1849: 1128; Collin 1914: 236; Richards 1930: 318.

Sphaerocera parapusilla Duda (*partim*) 1920: 32; Duda 1938: 32.

Ischiolepta vaporariorum; Papp 1973a: 358; 1978: 394; 1984: 70; Hackman 1980: 147; Roháček 1978: 244; Roháček & Papp 1984: 478; Pitkin 1988: 34; Florén 1989: 4.

(?) *Ischiolepta vaporariorum*; Nishijima & Yamazaki 1984: 87.

Diagnosis. *Ischiolepta vaporariorum* is very similar to *I. pusilla* and can be distinguished by the following characters: male cerci not projecting ventrally; dorsal sclerite of distiphallus projecting forward (Fig. 159). The female cannot be separated from that of *I. pusilla* without association with male specimens. As in *I. pusilla*, two forms of hind femora occur in the male: thick and slender.

Description. Body subshiny or dull, dark brown; 2.2–2.3 mm long.

Male. Head (Fig. 152 and 153). Black, subshiny; lunule dark brown, small, crescentic; inner and outer vertical setae, 2 fronto-orbital setae small but distinct, about same in length; outer vertical seta on very weak tubercle; epistoma blackish brown, granulated; clypeus about 1.5 times as wide as long, pollinose except lower margin; gena dark brown, shiny; facial ridge with thick vibrissa, 3–4 long, hairlike subvibrissal setae, and sparse, short, hairlike setae; eye more or less elliptic in lateral view. *Thorax.* Black, dull; most setae on weak tubercles, or setae longer than tubercles; acrostichal setae in 4 irregular rows on presutural area of scutum; row of dorsocentral setae distinctly separate from acrostichal setae, bare area between them moderately pollinose; scutellum black, subshiny, twice as wide as long with 7–8 marginal tubercles; katapisternum with sparse hairs ventrolaterally. *Legs.* Brown to yellowish brown, contrasting with dark thoracic pleura; hind femur polymorphic, strongly thickened or slender; hind tibia with strong apicoventral setae. *Wings.* Membrane hyaline; veins brown; halter pale brown. *Abdomen* (Fig. 154 and 155). Tergites 1+2, 3, 4 about equal in length; tergite 5 rectangular, half as long as tergite 4; preabdomen with 4 rectangular sternites; sternite 5 half as long as sternite 4; genitalia (Fig. 159 and 160) with surstylus long with apex gently rounded in lateral view; paramere small and slender with frontal pro-

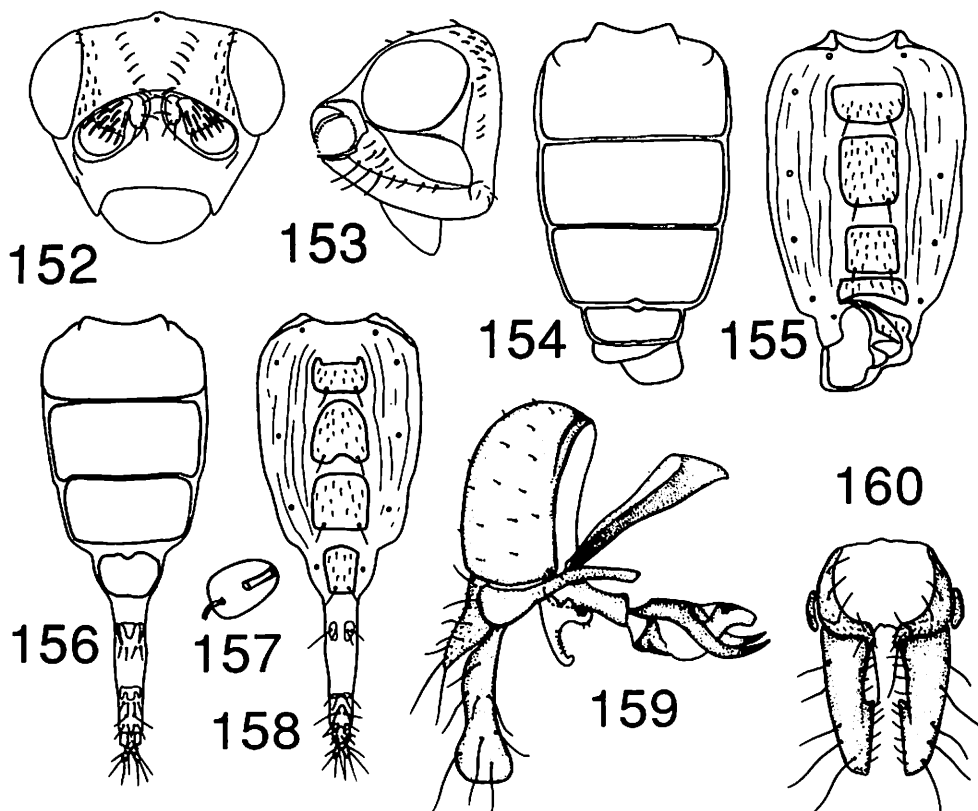


Fig. 152-160. *Ischiolepta vaporariorum*. (152) Female: head, frontal view. (153) Female: head, lateral view. (154) Male: abdomen, dorsal view. (155) Male: abdomen, ventral view. (156) Female: abdomen, dorsal view. (157) Spermatheca. (158) Female: abdomen, ventral view. (159) Male: genitalia, lateral view. (160) Male: genitalia, caudal view.

cess; basiphallus shorter than distiphallus; distiphallus with tubelike process apically, 1 pair of pointed processes arising from dorsal sclerite.

Female. Head, Thorax. As in male. **Abdomen** (Fig. 156-158). Tergite 1+2, tergite 3 and tergite 4 equal in length; tergite 5 small, entire; sternite 2 half as long as sternite 3; postabdomen largely membranous.

Type Material. Haliday (1836) stated that he found this species "commonly on deliquescent cucumber" and that F. Walker also collected it "near London." **LECTOTYPE:** ♂ (here designated, labeled by Kim in 1963). The lectotype specimen has four labels: "cucumber," "Ireland" (green label), "Haliday 20, 2, 82," and "vaporariorum." **PARALECTOTYPES:** 1 ♂, 2 ♀. Has two labels: "Ireland" (green label) and "Haliday 20, 2, 82." The labels with "Haliday 20, 2, 82" is the date of incorporation of the Haliday collection in the NCID rather than the date the specimens were collected (O'Connor & Nash 1982).

Other Material Examined. ENGLAND: 1 ♂, Herts., Felden, 24-XI-1896, A. Piffard (BMNH); 3 ♂♂, Herts., Felden, 30-XI-1896, A. Piffard (BMNH).

SWEDEN: 2 ♂♂, 3 ♀♀, Explot. Uppland, VIII-1922 (UZI). UNITED STATES: Illinois: 1 ♂ Urbana, 17-VI-1915 (WSU). Indiana: 1 ♂, 1 ♀, Lafayette, VI-1928, on alfalfa, J. M. Aldrich (USNM). Maryland: 1 ♀, Plummers Island, III-1919 (WSU). Minnesota: 1 ♂, Luverne, 15-VI-1938, at light (WSU). Montana: 1 ♂, Laurel, 24-III-1914 (WSU). New Mexico: 1 ♂, Santa Fe Co., Santa Fe, Baldy, 10,800-11,800', spruce-fir-tundra, 19-VI-4-VIII-1979, S. J. Peck (GUE). New York: 1 ♂, Ithaca, 26-IV-1914 (WSU). Tennessee: 1 ♀, Nashville, 24-IV, J. M. Aldrich (WSU). Washington: 1 ♀, Colfax, 12-VII-1956, pig excrement, M. Coffey (WSU); 1 ♂, Kamiac Butte, 11-VI-1912 (WSU); 4 ♂♂, Pullman, cow dung, pig excrement, VII-1956, M. Coffey (WSU); 1 ♂, Rosalis, cow dung, pig excrement, 13-VI-1953, M. Coffey (WSU); 1 ♂, Wawawai, 14-VIII-1956, M. Coffey (WSU).

Distribution. Holarctic.

Remarks. Pitkin (1988) indicated the thickness of the hind femur in *I. vaporariorum* is polymorphic. He sent us four male British specimens, of which three had strongly thickened hind femur and one had slender hind femora.

Table 1. Characters and character states used in the cladistic analysis of *Ischiolepta* spp.^a

Character	Character states
1	Inner vertical seta: (a) short, reaching at most half way to ocellar triangle; (b) long, reaching ocellar triangle. (a-b).
2	Outer vertical seta: (a) at most slightly tuberculate; (b) distinctly tuberculate; (c) on very large tubercle. (a-b-c).
3	Epistoma: (a) concolorous with frons; (b) distinctly yellowish, contrasting the dark frons. (a-b).
4	Clypeus: (a) dark, concolorous with frons; (b) yellow, contrasting with dark frons. (a-b).
5	Infragena: (a) not distinctly granulated; (b) distinctly granulated. (a-b).
6	Postocular setae: (a) slightly tuberculated; (b) distinctly tuberculated. (a-b).
7	Setae on thoracic dorsum: (a) setae distinctly longer than tubercles; (b) setae shorter than tubercles. (a-b).
8	A pair of calli on scutum anteriorly: (a) absent; (b) present. (a-b).
9	Acrostichal setae: (a) in four irregular rows; (b) tending to become two rows, at least on the presutural area of scutum; (c) dense and completely diffused. (c-a-b).
10	Marginal scutellar tubercles: (a) slender and short; (b) thick and long. (a-b).
11	Male hind femur: (a) long and slender; (b) distinctly thickened. (a-b).
12	Male abdominal tergite 5: (a) entire; (b) divided into two sclerites. (a-b).
13	Female abdominal tergite 5: (a) entire; (b) notched; (c) divided into two sclerites. (a-b-c).
14	Female abdominal sternite 5: (a) entire; (b) divided into two sclerites; (c) divided into three sclerites. (c-a-b).
15	Surstyli in caudal view: (a) not <i>I. vaporariorum</i> type; (b) <i>I. vaporariorum</i> type. (a-b).
16	Dish-shaped apicoventral process on distiphallus: (a) absent; (b) present. (a-b).
17	Tubelike apical process on distiphallus (as in <i>I. pusilla</i>): (a) absent; (b) present. (a-b).
18	Base of paramere: (a) short; (b) long. (a-b).

^a Characters state "a" is hypothesized as plesiomorphic and additional state(s) as apomorphic. Character polarity (or postulated evolutionary direction) is described in parentheses at the end of each character.

Inferred Phylogeny

Three taxa, *Ischiolepta*, *Lotobia*, and *Safari*, clearly form a monophyletic group with the following three synapomorphies: the presence of numerous blunt setae on tubercles; the postalar seta on elongated tubercles (Fig. 9); and the presence of six or more long marginal scutellar tubercles. We consider *Ischiolepta* more closely related to *Lotobia* than to *Safari* by the following synapomorphies: the scutellum with seven or more scutellar tubercles (Fig. 163 and 164) (except in highly apomorphic *I. flava*); and the acrostichal setae arranged in four or more irregular rows (at least behind the posterior half of the presutural area of the scutum) (Fig. 9). In *Safari*, the acrostichal setae are arranged in two rows, a condition also found in other genera of Sphaerocerinae. The possession of six marginal scutellar tubercles in *Safari* (Fig. 162) is interpreted as an intermediate character state apomorphic to two tubercles (as in Fig.

161). However, we found no definable synapomorphy for *Ischiolepta*. Although they may well comprise a paraphyletic group (Wiley 1981), the nominal species of *Ischiolepta* are taxonomically inclusive and morphologically consistent with a great morphological gap from *Lotobia*; thus, we consider *Ischiolepta* a monophyletic group for cladistic analysis. Monophyly of the selected taxonomic outgroup, *Lotobia*, is defined by the following synapomorphies: the presence of 11 or more marginal scutellar tubercles, the male surstylus bent inwards, and the distiphallus with a thick membranous sheath covering at least the basal half. Character polarity was determined using outgroup analysis in most cases (Characters 1–14, Tables 1 and 2), except for male genitalic characters that showed great interspecific differences. Only a few genitalic structures common to two or more species were used for cladistic analysis, and the presence of these structures was considered apomorphic, because it is less probable that a highly specialized plesiomorphic state would be retained in such a rapidly evolving structure (Characters 15–18).

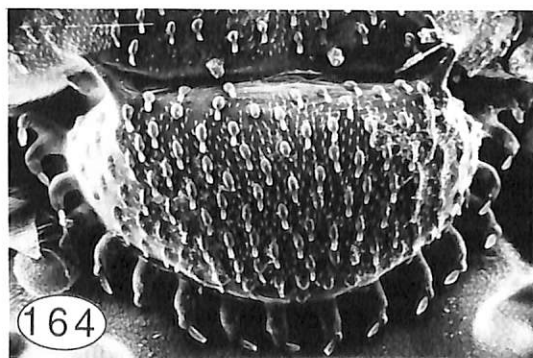
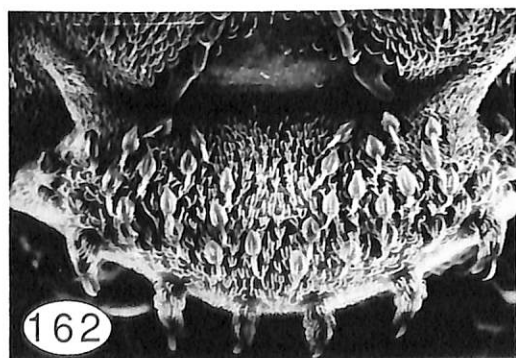
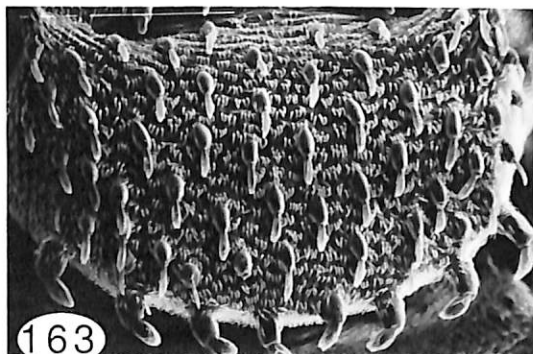
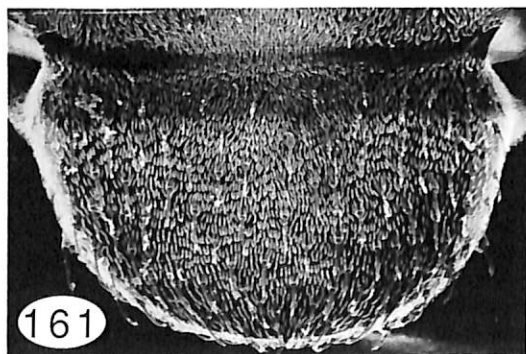
Ischiolepta scabricula is an aberrant species that differs considerably from other *Ischiolepta* in body and genitalic structure. Its cladistic relationship with other *Ischiolepta* species could not be resolved because of a lack of an obvious synapomorphy. This species is assigned to *Ischiolepta* based only on the number of its marginal scutellar tubercles. It may be more closely related to *Lotobia* than to the rest of *Ischiolepta*. Except for *I. scabricula*, the species of *Ischiolepta* are fairly well separated into two distinct groups by Characters 2, 7, and 11 (Fig. 165); they are referred to as the *pusilla* group and the *denticulata* group.

Within the *pusilla* group, which includes eight species, a sister-group relationship between *I. draskovitsae* and *I. orientalis* is strongly suggested by three synapomorphies (Characters 1, 3, 4). Of these characters, long inner vertical seta (Character 1) also is found in *Lotobia kivuensis* of the taxonomic outgroup; we consider this character independently acquired in both taxa. The three species *I. oedopoda*, *I. horrida*, and *I. longispina* form a distinct monophyletic group by sharing an extensively granulated genal area (Character 5). Although the extreme granulation of the infragena also is found in *Sphaerocera*, it is considered apomorphic because the granulation is much more intense and extends to the facial ridge in those three species. The cladistic relationships among the three species could not be fully resolved because males of *longispina* were not available. *I. vaporariorum* is hypothesized to be the sister-species of these taxa because all three have a similar surstylus structure (Character 15).

All *pusilla* group species occur in the Palearctic Region (Fig. 165). Two widely distributed species, *I. pusilla* and *I. vaporariorum*, extend into the Nearctic Region. They may have been introduced into the New World via a land bridge that has been

Table 2. Character state distribution of characters used in cladistic analysis of *Ischiolepta* spp.

Species of <i>Ischiolepta</i> ^a																		
Char- acter	<i>scabricula</i>	<i>nitida</i>	<i>draskovitsae</i>	<i>orientalis</i>	<i>pusilla</i>	<i>vaporariorum</i>	<i>oedopoda</i>	<i>horrida</i>	<i>longispina</i>	<i>micropyga</i>	<i>loebli</i>	<i>flava</i>	<i>pansa</i>	<i>stuarti</i>	<i>crenata</i>	<i>intermedia</i>	<i>scabra</i>	<i>denticulata</i>
1	a	a	b	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a
2	a	a	a	a	a	a	a	a	a	b	b	c	c	c	b	b	b	b
3	a	a	b	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a
4	a	a	b	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a
5	a	a	a	a	a	a	b	b	b	a	a	a	a	a	a	a	a	a
6	?	a	a	a	a	a	a	a	a	a	a	a	a	a	b	b	b	b
7	?	a	a	a	a	a	a	a	a	b	b	?	b	b	b	b	b	b
8	a	a	a	a	a	a	a	a	a	a	a	a	b	b	a	a	a	a
9	c	a	a	a	a	a	a	a	a	a	a	a	b	b	b	b	b	b
10	a	a	a	a	a	a	a	a	a	a	a	b	b	b	a	a	a	a
11	a	b	b	b	a/b	a/b	b	b	b	a	a	a	b	a	a	a	a	a
12	a	a	a	a	a	a	a	a	?	a	a	?	b	b	a	a	b	b
13	?	a	?	a	a	a	a	a	a	a	a	?	a	a	b	c	c	c
14	?	a	?	a	a	a	a	b	a	a	a	?	a	a	c	a	a	b
15	a	a	a	a	a	b	b	b	?	a	a	a	a	a	a	a	a	a
16	a	a	a	a	a	a	a	a	?	a	a	?	b	a	a	b	b	b
17	a	a	a	a	b	b	b	b	?	a	a	?	a	a	a	a	a	a
18	b	a	a	a	a	a	a	a	?	a	b	?	b	b	b	b	b	b

^a ?, unresolved character states.Fig. 161-164. Scutellum of Sphaerocerinae. (161) *Sphaerocera curvipes*. (162) *Safaria* sp. (163) *Ischiolepta pusilla*. (164) *Lotobia moyoensis*.

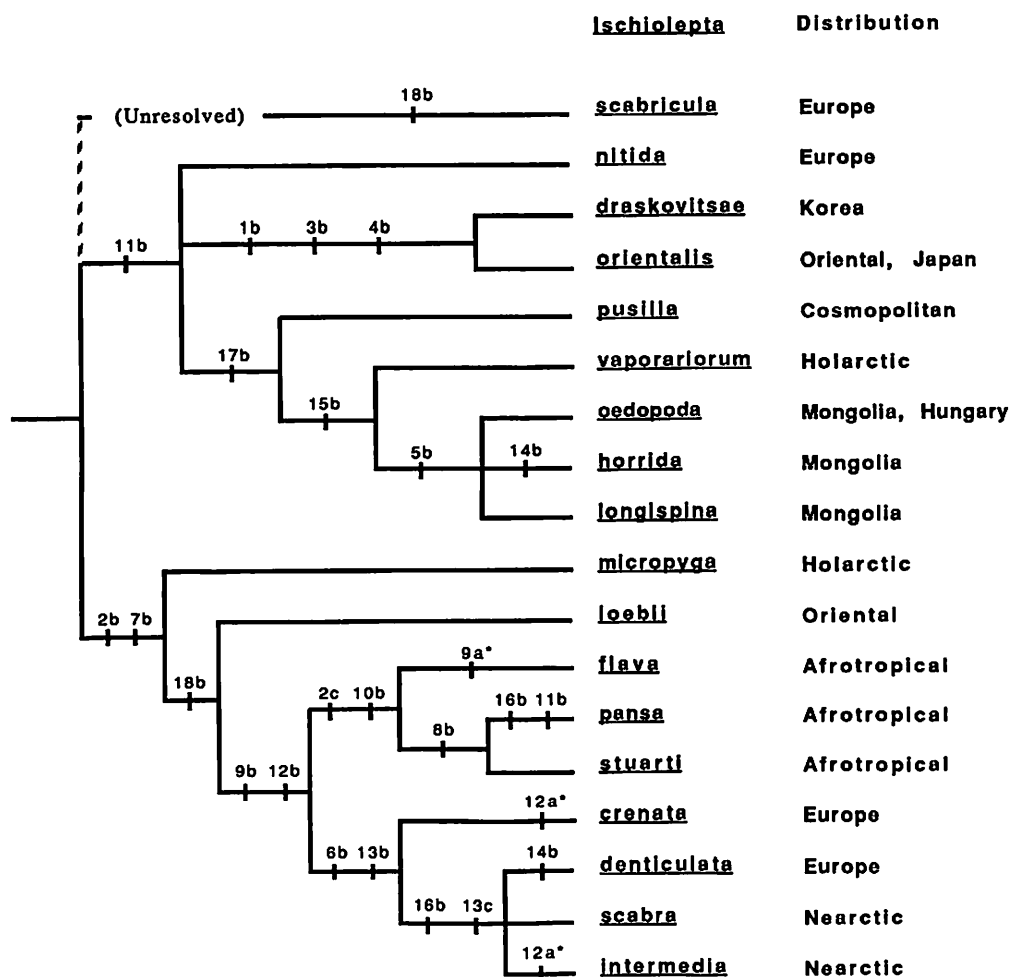


Fig. 165. Cladogram of *Ischiolepta*. Numbers and letters refer to characters and states representing synapomorphies or homoplasies. Asterisks indicate character reversal.

repeatedly formed in the Bering Sea area in the late Cenozoic (Matthews 1979), although these flies might have arrived through human commerce. *I. pusilla* also has been recorded from North Africa, Australia, and South America (Papp 1978), where it was apparently introduced. This is the most common and widely distributed species of *Ischiolepta*, and it has a wide range of temperature tolerance from Afghanistan to Alaska. Of the *pusilla* group, the clade consisting of *I. longispina*, *I. horrida* and *I. oedopoda* is primarily Mongolian, but *I. draskovitsae* and *I. orientalis* are restricted to Korea, Japan, and the Oriental Region.

Relationships within the *denticulata* group, which includes nine species, are generally well resolved. *I. scabra*, *I. intermedia*, and *I. denticulata*, (which form a monophyletic group) share a very specialized dish-shaped apicoventral process on the distiphallus (Character 16) and a divided abdominal tergite 5 in the female (Character 13). Three African species, *I. stuarti*, *I. pansa*, and *I. flava*

(the unexamined species *I. vanschuytbroeckii* also is probably related), are related and form a monophyletic group, sharing very similar outer vertical setae (Character 2) and scutellar structures (Character 10). Of these species, *I. stuarti* and *I. pansa* are more closely related, as indicated by another synapomorphy (Character 8). The other six species, plus *I. crenata*, form a larger monophyletic group. All share a similar arrangement of acrostichal setae (Character 9) and, except in *I. intermedia* and *I. crenata*, a divided male fifth tergite (Character 12). The presence of state 12a in *I. intermedia* and *I. crenata* is considered a reversal.

In contrast to the *pusilla* group, species of the *denticulata* group show substantial biogeographic divergence. The three closely related African species *I. stuarti*, *I. pansa*, and *I. flava* seem to have undergone relatively rapid morphological differentiation with a substantial number of autapomorphies. Of these species, *I. flava* has the largest number of autapomorphies, including the development of huge

rod-shaped setae and a largely membranous abdomen. In the relatively well-defined monophyletic group containing *I. denticulata*, *I. intermedia*, and *I. scabra*, their similar genitalic structure may reflect recent speciation.

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References Cited

- Becker, T. 1902. Die Meigen'schen Typen der Sogen. Muscidae Acalyptratae (Muscaria Holometopa) in Paris und Wien [part]. Z. Syst. Hym. Dipt. 2: 337-349.
1905. Borboridae, pp. 23-37. In T. Becker et al. [eds.], Katalog der Paläarktischen Dipteren, Band IV. Cyclorrhapha, Schizophora, Holometopa. Budapest, Hungary.
1907. Die Ergebnisse meiner dipterologischen Frühjahresreise nach Algier und Tunis. Z. Syst. Hym. Dipt. 7: 369-470.
- Collin, J. E. 1914. Notes on the specimens of Borboridae and some Ephydriidae in the Haliday collection at the National Museum, Dublin. Sci. Proc. R. Dublin Soc., New Ser. 17: 235-255.
- Duda, O. 1920. Revision der altweltlichen Arten der Gattung *Sphaerocera* Latreille (Dipteren). Tijdschr. Entomol. 63: 1-39.
1938. 57. Sphaeroceridae (Cypselidae), pp. 1-82. In E. Lindner [ed.], Die Fliegen der Palaearktischen Region, vol. 6. Stuttgart.
- Falcoz, L. 1921. Matériaux pour l'étude de la faune pholéophile. 1re note: Diptères avec la description d'une espèce nouvelle de *Sphaerocera* Latr. Bull. Soc. Entomol. Fr. 1921: 137-142.
- Fallén, C. F. 1820. Heteromyzides Sveciae. Lundae (Lund), Sweden.
- Felsenstein, J. 1984. The statistical approach to inferring evolutionary trees and what it tells us about parsimony and compatibility, pp. 169-191. In T. Duncan & T. F. Stussy [eds.], Cladistics: perspectives on the reconstruction of evolutionary history. Columbia University Press, New York.
1987. PHYLIP (Phylogeny Inference Package) version 3.0. Copyrighted by University of Washington.
- Florén, F. 1989. Distribution, phenology and habitats of the lesser dung fly species (Diptera, Sphaeroceridae) of Sweden and Norway, with notes from adjacent countries. Entomol. Tidskr. 110: 1-29.
- Hackman, W. 1977. Family Sphaeroceridae (Borboridae), pp. 399-406. In M. D. Delfinado & D. E. Hardy [eds.], A catalog of the diptera of the oriental region, vol. III. Suborder Cyclorrhapha (excluding division Aschiza). University Press of Hawaii, Honolulu.
1980. A check list of the Finnish Diptera, II. Cyclorrhapha. Notul. Entomol. 60: 117-162.
- Haliday, A. H. 1836. British species of the dipterous tribe Sphaeroceridae. Entomol. Mag. 3: 315-336.
1839. New British insects indicated in Mr. Curtis's guide. Ann. Nat. Hist. 2: 183-190.
- Harrison, R. A. 1959. Acalyptrate Diptera of New Zealand. New Zealand Department of Science and Industry Research Bulletin 128.
- Hendel, F. 1921. Zwei neue europäische Dipteren-gattungen. Wien. Entomol. Z. 38: 53-56.
- Horn, W. & I. Kahle. 1935-1937. Über entomologische Sammlungen, Entomologen und Entomo-Museologie. Entomologische Beihefte, Band 2-4. Berlin.
- Howard, L. O. 1900. A contribution to the study of the insect fauna of human excrement. Proc. Wash. Acad. Sci. 2: 541-604.
- Kim, K. C. 1968. Revision of *Sphaerocera*, with description of a new genus, *Afromyia* (Diptera: Sphaeroceridae). Ann. Entomol. Soc. Am. 61: 296-312.
- 1972a. Notes on types of Sphaeroceridae by Fallén, Stenhammar, and Zetterstedt, with lectotype of *Copromyza equina* (Fall.) (Diptera). Entomol. News 83: 203-217.
- 1972b. The New World genus *Parasphaerocera* and allied groups, with descriptions of new genera and species (Diptera: Sphaeroceridae), pp. 377-444. In Miscellaneous Publication 8, Entomological Society of America, College Park, Md.
- Kim, K. C. & E. F. Cook. 1966. A comparative external morphology of adult Sphaeroceridae, pp. 78-100. In Miscellaneous Publication 5, Entomological Society of America, College Park, Md.
- Lioy, P. 1864. I ditteri distribuiti secondo un nuovo metodo di classificazione naturale. Atti Ist. Veneto Sci. Lett. Arti cl. Sci. Mat. Nat., ser. 3, 9: 1087-1126.
- Malloch, J. R. 1925. A synopsis of New World flies of the genus *Sphaerocera* (Diptera: Borboridae). Proc. Entomol. Soc. Wash. 27: 117-123.
- Marshall, S. A. & O. W. Richards. 1987. Sphaeroceridae, pp. 993-1006. In J. F. McAlpine et al. [eds.], Manual of Nearctic Diptera, vol. 2. Agriculture Canada, Ottawa.
- Mathews, J. V., Jr. 1979. Tertiary and Quaternary environments: historical background for an analysis of the Canadian insect fauna, pp. 32-86. In H. V. Danks [ed.], Canada and its insect fauna. Memoirs of the Entomological Society of Canada 108, Ottawa.
- McAlpine, J. F. 1981. Morphology and terminology—adults, pp. 9-63. In J. F. McAlpine et al. [eds.], Manual of Nearctic Diptera, vol. 1. Agriculture Canada, Ottawa.
- Meigen, J. W. 1830. Systematische Beschreibung der bekannten europaischen zweiflügeligen Insekten, vol. 6. Hamm.
1838. Systematische Beschreibung der bekannten eu-

- ropaeischen zweiflügeligen Insekten, vol. 7 (supplementary volume). Hamm.
- Meijere, J. C. H. de. 1908. Studien über südostasiatische Dipteren. II. Tijdschr. Entomol. 51: 105-180.
- Nishijima, Y. & K. Yamazaki. 1984. Studies on the sphaerocerid flies from Hokkaido, with descriptions of two new species (Diptera, Sphaeroceridae), pp. 73-95. In Memorial Papers of Dr. H. Kôno Twentieth Anniversary, Sapporo.
- Norrbom, A. L. 1986. Lectotype designations for the species of Copromyzinae (Diptera: Sphaeroceridae) described by Haliday. Entomol. News 98: 46-50.
- O'Connor, J. P. & R. Nash. 1982. Notes on the entomological collection of A. H. Haliday (1806-1870) in the National Museum of Ireland, with a recommendation for type designations. Proc. R. Ir. Acad. Sect. B, Biol., Geol., Chem. Sci. 82: 169-175.
- Papp, L. 1972. A new species of *Ischiolepta* (Dipt., Sphaeroceridae). Folia Entomol. Hung. 25: 469-472.
- 1973a. Sphaerocerids from Balearic Islands and Finland. Folia Entomol. Hung. 26: 357-362.
- 1973b. Sphaeroceridae (Diptera) from Mongolia. Acta Zool. Acad. Sci. Hung. 19: 369-425.
1978. Sphaeroceridae (Diptera) in the collection of the Hungarian Natural History Museum. IV. Sphaerocerinae. Acta Zool. Acad. Sci. Hung. 24: 371-395.
1984. Family Sphaeroceridae, pp. 68-107. In A. Soós & L. Papp [eds.], Catalogue of Palearctic Diptera, vol. 10. Elsevier, Amsterdam.
1988. Sphaerocerinae and Copromyzinae (Sphaeroceridae, Diptera) from the Oriental Region. Rev. Suisse Zool. 95: 461-469.
- Pitkin, B. R. 1988. Lesser dung flies, Diptera: Sphaeroceridae. Handbook for the Identification of British Insects, vol. 10, part 5e. London.
- Richards, O. W. 1930. The British species of Sphaeroceridae (Borboridae, Diptera). Proc. Zool. Soc. London 18: 261-345.
1938. A species of *Sphaerocera* (Diptera: Sphaeroceridae) new to Britain. Proc. R. Entomol. Soc. Lond. 7: 127-130.
- 1965a. Family Sphaeroceridae (Borboridae, Diptera), pp. 718-726. In A. Stone et al. [eds.], A catalog of the Diptera of America north of Mexico. USDA Agriculture Handbook 276.
- 1965b. A contribution to the study of the genus *Sphaerocera* Latreille in Central and South America (Diptera: Sphaeroceridae). Proc. U.S. Natl. Mus. 116 (3054): 223-242.
1973. The Sphaeroceridae (=Borboridae or Cypselidae; Diptera: Cyclorrhapha) of the Australian Region. Aust. J. Zool., Suppl. Ser., No. 22: 297-401.
1980. Family Sphaeroceridae, pp. 614-626. In R. W. Crosskey [ed.], Catalogue of the Diptera of the Afrotropical Region. British Museum (Natural History), London.
- Roháček, J. 1978. Preliminary list of Sphaeroceridae (Diptera) from Czechoslovakia. Dipterol. Bohemoslovaca 1: 243-253.
- Roháček, J. & L. Papp. 1984. *Ischiolepta* Liroy (Diptera: Sphaeroceridae): two new species and taxonomical notes. Acta Zool. Acad. Sci. Hung. 30: 469-479.
- Rondani, C. 1880. Species Italicae ordinis dipterorum (Muscaria Rndn.) collectae et observatae. Stirps 25. Copromyzinae Zett. Bull. Soc. Entomol. Ital. 12: 3-45.
- Schiner, I. R. 1864. Fauna Austriaca. Die Fliegen, Diptera. 2. Vienna.
- Séguy, E. 1934. Dipteres (Brachyceres) (Muscidae, Acalyptrae et Scatophagidae). Faune de France 28.
- Spuler, A. 1924. North American species of the genus *Sphaerocera* and *Aptilotus* (Diptera: Borboridae). Pan-Pac. Entomol. 1: 66-71.
- Stenhammar, C. 1855. Skandinaviens Copromyzinae granskade och beskrifne. K. Sven. Vetenskapsakad. Handl. 74: 257-442.
- Strobl, G. 1900. Spanische Dipteren. IX. Wien. Entomol. Z. 19: 61-70.
- Vanschuytbroeck, P. 1942. Diptères Sphaerocerides nouveaux pour la faune belge. Bull. Mus. R. Hist. Nat. Belg. 18(19): 1-12.
1943. Notes sur la faune des Hautes-Fagnes en Belgique. X. Diptera: Sphaeroceridae (Borboridae). Bull. Mus. R. Hist. Nat. Belg. 19: 1-12.
1948. Sphaeroceridae (Diptera, Acalyptratae). Exploration du Parc National Albert, Mission G. F. de Witte (1933-35), Fascicule 52: 1-43.
1951. Contribution à l'étude des Sphaeroceridae africains (Diptera Acalyptratae). Bull. Mus. R. Hist. Nat. Belg. 27(33): 1-16.
- 1959a. Sphaeroceridae. Exploration du Parc National de L'Upemba, Mission G. F. de Witte (1946-1949), Fascicule 57: 1-63.
- 1959b. Sphaerocerinae, Limosinae, Ceropterinae (Diptera, Ephydroidea). Exploration du Parc National de Garamba Mission H. de Saeger (1949-1952), Fascicule 17: 15-85.
- Villeneuve, J. 1914. Notes synonymiques. Wien. Entomol. Z. 33: 207-208.
- Walker, F. 1849. List of the specimens of dipterous insects in the collection of the British Museum, vol. 4, pp. 1127-1133. London.
- Wiley, E. O. 1981. Phylogenetics. Wiley, New York.
- Zetterstedt, J. W. 1840. Insecta Lapponica Descripta. Lipsiae (Leipzig).
1847. Diptera Scandinaviae. Disposita et descripta, vol. 6. Lundae (Lund).

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