

Phylogeny and Taxonomy of the *Risa* Genus-group (Diptera: Ephydriidae), with Description of a New Genus from Australia

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ABSTRACT. The systematic and somewhat controversial history of *Risa* Becker is presented, and its relationship with *Diasemocera* Bezzi (tribe Psilopini, Ephydriidae) is documented by morphological evidence and an association with host plants in the family Amaranthaceae. The tribe Risini Papp (as Risidae) is synonymized with Psilopini Cresson. *Notorisa* gen. nov., from Australia, is described (type species: *Notorisa mcalpinei* sp. nov.; Australia, Victoria: Big Desert National Park, near Lake Hindmarsh; 36°03.7'S 141°54.8'E). *Achaetorisa* Papp is retained as a subgenus within *Risa* and includes five species, including two new combinations: *Risa brevicornis* (Papp) comb. nov., *Risa salsolae* (Mathis & Zatwarnicki) comb. nov., and two new species: *R. brevirostris* sp. nov. (Israel, Zomet Zohar; 31°08.5'N 35°21.6'E) and *R. nettae* sp. nov. (Israel, Zomet Zohar; 31°08.5'N 35°21.6'E). A fourth new species is described in the subgenus *Risa*: *R. (Risa) kotrbae* sp. nov. (Israel, Zomet Zohar; 31°08.5'N 35°21.6'E).

Introduction

The genera and species included in the “the *Risa* group” have been the source and subject of controversy and debate since their first description. Specimens of these taxa are real, but their hypothetical and phylogenetic placement within the higher classification of Acalyptratae (Diptera: Schizophora) has been historically unstable, depending on which character suites were employed and analyzed and interpretations of variable characters. This situation is perhaps to be expected when dealing with specimens that are tiny (body length 1–3 mm), dark colored and shiny, rarely collected, and demonstrate considerable reduction in setation, wing venation, and structures of the male and female terminalia. This reduction is sometimes by convergence in

the phenotypic expression of some characters, especially those of mouthparts, which are moderately to remarkably long and with a geniculate proboscis. Specimens are generally rare in collections, and some species are known only from their type localities.

Although the proposed classifications of the *Risa* group lack complete resolution, progress has been made, and in recent decades, the focus has narrowed to differing placements of the group within the superfamily Ephydroidea (Wiegmann *et al.*, 2011; Winkler *et al.*, 2022). Further resolution of this phylogenetic and classificatory puzzle is the overall objective of this paper in addition to describing new taxa. First, however, some historical background.

Becker (1907) described *Risa* and its only included species, *R. longirostris* Becker (a male and female from

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Biskra, Algeria). Becker (1907) first placed *Risa* in the family Ephydriidae, subfamily Agromyzinae. Thereafter, however, there has been little agreement on the placement of the genus. Melander (1913) was the first to associate *Risa* with Milichiidae and therein to the Madizina group. Hennig (1937) redescribed Becker's types and suggested that *Risa* be placed in the family Milichiidae (subfamily Carninae). Despite having misgivings, Hennig (1965: 184) continued placement in Milichiidae ("Die Gattungen *Horaismoptera* und *Risa*, die ich früher (1937) zu den Carnidae ("Carninae") stellte, haben stark nach hinten verlängerte Labellen und dürften daher zu den Milichiidae gehören." English: "The genera *Horaismoptera* and *Risa*, which I formerly (1937) included in the Carnidae ("Carninae"), have strongly elongated labellum directed backwards, and should therefore belong to the Milichiidae.") and again in 1973 (p. 61) Milichiidae (subfamily Madizinae). Papp (1977) was the first to attribute familial status for *Risa* (Risidae). Later, Papp (1984) cataloged the family, noting that *Achaetorisa brevicornis* Papp was parasitic on its host caterpillar. J. F. McAlpine (1989) questioned the necessity for a separate family in his discussion on the phylogeny of the Risidae and included skeptical comments on the parasitic relationships noted previously. J. F. McAlpine (1989) suggested that *Risa* is no more than a genus of Milichiidae. More recently, Kotrba & Mathis (2009) described the internal female reproductive tract of *Risa*, discussed the relationship of *Risa* with Ephydriidae, and first suggested its membership in the subfamily Discomyzinae Acloque. Although the phylogenetic relationships and familial status of *Risa* are now better resolved, there is much need for further research at both the descriptive and phylogenetic levels. These taxa generally remain poorly understood and studied.

At the species level, additional taxa and locality data were added. Steyskal (1968) recorded a specimen from Egypt, and Papp (1977) recharacterized the type species, designating a lectotype, and described *R. mongolica*. Papp (1980) then described *R. longicornuta* and a second genus and its included type species, *Achaetorisa brevicornis* Papp. The latter species was described from 20 specimens from Morocco, some allegedly reared from a caterpillar found on *Halogeton sativus* (L.) Moq. (Amaranthaceae). Ozerov (1984, 1992) described three new species in *Risa*: *R. asiatica*, *R. flavipalpis*, and *R. nartshukae* but subsequently synonymized the latter with *R. longirostris*. More recently, Mathis & Zatwarnicki (2017) described *Achaetorisa salsolae* from the United Arab Emirates and Krivosheina and Ozerov (2019) added *Risa flavicoxa* from central Asia. Thus, until now the so-called family has included seven valid species in two genera. No fossils are known.

The *Risa* group of genera occurs in arid regions of the Old World and has greatest diversity along the great desert belt, extending from northwest Africa through the Near East to Mongolia.

Our purposes herein are to describe additional new species and to describe a new genus and species from Australia, *Notorisa mcalpinei*. The latter genus and species have further contributed to our knowledge of the group and provided additional evidence that this group should be placed in the shore-fly family Ephydriidae, subfamily Discomyzinae, tribe Psilopini Cresson.

Risa and *Notorisa* are somewhat anomalous genera, demonstrating several structurally derived conditions,

especially in external characters of the head that have posed difficulties in placing the family within the Ephydroidea, including, as noted previously, recognition as a separate family or tribe (Papp, 1977). *Risa*, for example, was included prominently in analyses and discussions of the Ephydroidea (Chandler, 1987; Grimaldi, 1990; Wiegmann *et al.*, 2011; Winkler *et al.*, 2022). An improved phylogenetic framework available for the Ephydroidea and for the family Ephydriidae (Chandler, 1987; Zatwarnicki, 1992; Mathis & Zatwarnicki, 1995) provides the context for this paper, including placement of these genera within the shore-fly tribe Psilopini Cresson (see "Discussion" associated with the tribal diagnosis).

The impetus for this paper came from discovery of new species of *Risa* Becker from Israel and the Sinai (Egypt) and of a new genus and species from Australia. Also contributing significantly was the availability of larger series, including numerous specimens of the new species, especially from the Middle East and Australia. The availability of large series was tremendously increased with discovery of a biological association between *Risa* and plants of the family Amaranthaceae (including the former goosefoot family Chenopodiaceae).

In summary, although *Risa* has hitherto been enigmatic and rare in collections, it now appears to be more common and widespread than previous locality data had indicated. An important outcome of this study is the establishment of a strong association between *Risa* and various species of the plant family Amaranthaceae. This has already supplied us with information about where potentially to look for these flies. Wherever an association with a plant species was established, many specimens were easily and relatively quickly collected. It may be that all the species are associated with Amaranthaceae, although this remains unsubstantiated for a majority of species. About half of the species have been known from a single locality, indicating that additional species probably exist and await discovery and description.

Methods and materials

The descriptive terminology, with the exceptions noted in Mathis (1986) and Mathis & Zatwarnicki (1990a), follows Cumming & Wood (2017). Because specimens are small, usually less than 3.5 mm in length, study and illustration of the male terminalia required use of a compound microscope. We have followed the terminology of Zatwarnicki (1996) for most structures of the male terminalia, which differs from the terminology that other workers in Ephydriidae have used (see references in Mathis, 1986, and Mathis & Zatwarnicki, 1990a, 1990b) such as the use of gonostylus instead of surstylus. The term surstylus is based on the erroneous assumption that the "clasping lobe" in *Cyclorhapha* does not have a muscular connection with the epandrium. There is no evidence of its secondary origin in *Eremoneura* and its musculature is easily homologized throughout all Brachycera. We follow the terminology for mouthparts that was proposed by Clausen & Cook (1971) and Zatwarnicki & Ryczko (2014). We use the term basal flagellomere for the large antennomere beyond the pedicel. We prefer this term over "first flagellomere" as there may be more than one flagellomere involved, and basal does not imply a number or numbers. We likewise do not use "postpedicel" (Stuckenberg, 1999) for this antennomere because at least the multisegmented arista is beyond the pedicel in addition

to the large antennomere, and postpedicel is thus ambiguous and lacking precision. Terminology for structures of the male terminalia is provided directly on Figs 16–19. Species descriptions are composite and are not based solely on the respective holotypes.

External morphological characters were drawn using an ocular grid attached to a stereoscopic dissecting microscope. Internal genitalia features were drawn using a camera lucida with a Nikon Labophot2 and were rendered using the graphic software Micrografx Designer 7.0. Photographs of habitus were taken with a Canon EOS 7D (18 Mp) camera with a zoom objective 70–200/f4 and a Nikon 10×/0.3 Plan Fluor microscopic objective. The images were then combined, using licensed stacking software, Zerene Stacker.

Five head and two venational ratios that are used in the descriptions are defined below (all ratios are based on three specimens (the largest, smallest, and one other): Costal vein ratio: the straight-line distance between the apices of R_{2+3} and R_{4+5} /distance between the apices of R_1 and R_{2+3} ; M vein ratio: the straight-line distance along vein M between crossvein dm–cu and r–m divided by the distance apicad of crossvein dm–cu; Antennal ratio: length of antenna/longest diameter of eye; Basal flagellomere ratio: length/width (sometimes referred to as “height”); Gena-to-eye ratio is the genal height measured at the maximum eye height divided by the eye height; Labellar ratio: length of labellum divided by length of ventral head margin; Medial-to-lateral vertical setal ratio: length of medial vertical seta divided by length of lateral vertical seta.

This study was based on specimens from the following museums (with acronyms used in the text and names of curators and assistant persons given in parentheses):

AM	Australian Museum, Sydney, Australia (Daniel J. Bickel, Russell Cox, and David K. McAlpine)
ANIC	Australian National Insect Collection (David Yeates)
HNHM	Hungarian Natural History Museum, Budapest, Hungary (László Papp† and Zoltán Soltész)
INHS	Illinois Natural History Survey, Champaign, Illinois (Stephen D. Gaimari and Donald W. Webb)
NMWC	National Museum of Wales, Cardiff, Wales (John Deeming, Martin J. Ebejer)
SMNH	Steinhardt Museum of Natural History, Tel-Aviv University, Tel-Aviv, Israel (Netta Dorchin, Amnon Freidberg†, and Elizabeth Morgulis)
USNM	former United States National Museum, collections in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (Torsten Dikow)

Taxonomy

Family Ephydriidae Zetterstedt

Subfamily Discomyzinae Acloque

Tribe Psilopini Cresson

- Psilopini Cresson, 1925: 241 (as Psilopininae). Type genus: *Psilopa* Fallén, 1823.—Mathis & Zatwarnicki, 1995: 30–50 [world catalog].
- Heringinae Enderlein, 1934: 191. Type genus: *Heringium* Enderlein, 1934 (= *Clanoneurum* Becker, 1903).
- Clanoneurinae Enderlein, 1936: 168. Type genus: *Clanoneurum* Becker, 1903.
- Risini Papp, 1977: 188 (as Risidae). Type genus: *Risa* Becker, 1907 **syn. nov.**

Diagnosis. The tribe Psilopini is distinguished from Discomyzini and other tribes of Ephydriidae by the following combination of characters: Small to moderately small shore flies, body length 1.50–2.50 mm; usually mostly black, shiny, microtomentum usually sparse, especially on frons and scutum.

Head: Ocellar seta aligned behind anterior ocellus, sometimes only slightly so; reclinate fronto-orbital seta inserted behind, sometimes weakly developed or lacking, laterocline (sometimes well developed, divergent, and slightly procline), usually much less than ½ length of ocellar seta; arista with 7–14 dorsal rays; conformation of face variable, usually mostly smooth, sometimes distinctly carinate, shallowly pitted or rugose; gena, including midportion, setulose, its posterior margin rounded, mouthparts sometimes moderately to distinctly geniculate, length of labellum equal to haustellum.

Thorax: Mesonotum generally sparsely microtomentose to bare, subshiny or shiny, although variable; supra-alar seta usually lacking, if present, well developed, subequal to postalar seta; arrangement of acrostichal setulae variable; prescutellar acrostichal setae usually present, widely set apart and aligned anterior of posteriormost dorsocentral setae; scutellum usually sparsely setulose; anterior and posterior notopleural setae inserted at about the same level. Wing hyaline to milky white; costal length variable; crossvein dm–cu sometimes lacking.

Abdomen: Male terminalia: Epandrium and cerci distinctive; gonostylus well developed, rarely reduced in some *Psilopa* Fallén; subepandrial plate present, this plate fused in some genera with pregonite; pregonite elongate, setulose; postgonite small, bearing 1–6 setae (usually 3); aedeagus ovate in ventral view; ejaculatory apodeme lacking; phallapodeme narrow, triangular in lateral view; hypandrium broad, medially incised.

Discussion. The position of the *Risa* group of genera within the Ephydriidae is supported by the following characters: Head: Postocellar setae absent. Thorax: Anal vein atrophied; hence anal cell absent. Abdomen: Spiracles 2–5 included in tergites; abdominal spiracle 7 absent in both sexes; tergites 6 and 7 of male reduced, much shorter than preceding tergite; sternites 6 and 7 of male lost; sternite 8 of male completely lost (Fig. 1).

Structures of the male terminalia of the *Risa* group include a few characters that are also found apparently in the shore-fly tribe Atissini (Ephydriidae: Hydrelliinae). Externally, moreover, there is some resemblance also with specimens of Gymnomyzini (Ephydriidae: Gymnomyzinae), and the primitive type of cibarium and lack of presutural dorsocentral setae suggest placement in Discomyzinae or Gymnomyzinae. However, the presence of a subepandrial plate, setose pregonites, which are attached to subepandrial plate, and lack of an ejaculatory apodeme are more typical for Discomyzinae, and like other genera of Psilopini, the pseudopostocellar setae are weakly developed with their length being considerably less than half that of the ocellar setae and the stem of the radial vein lacks setulae.

The tribe Psilopini is closely related to Discomyzini, and these two tribes constitute the subfamily Discomyzinae (Fig. 1). Worldwide, the tribe Psilopini comprises 14 genera and 159 species (Mathis & Zatwarnicki, 1995 and electronic updates). As noted in the above synonymy, we place the tribe Risini as a junior synonym of Psilopini and refer to the taxa formerly placed in Risini as the *Risa* group of genera. Like other genera of Psilopini, the pseudopostocellar setae

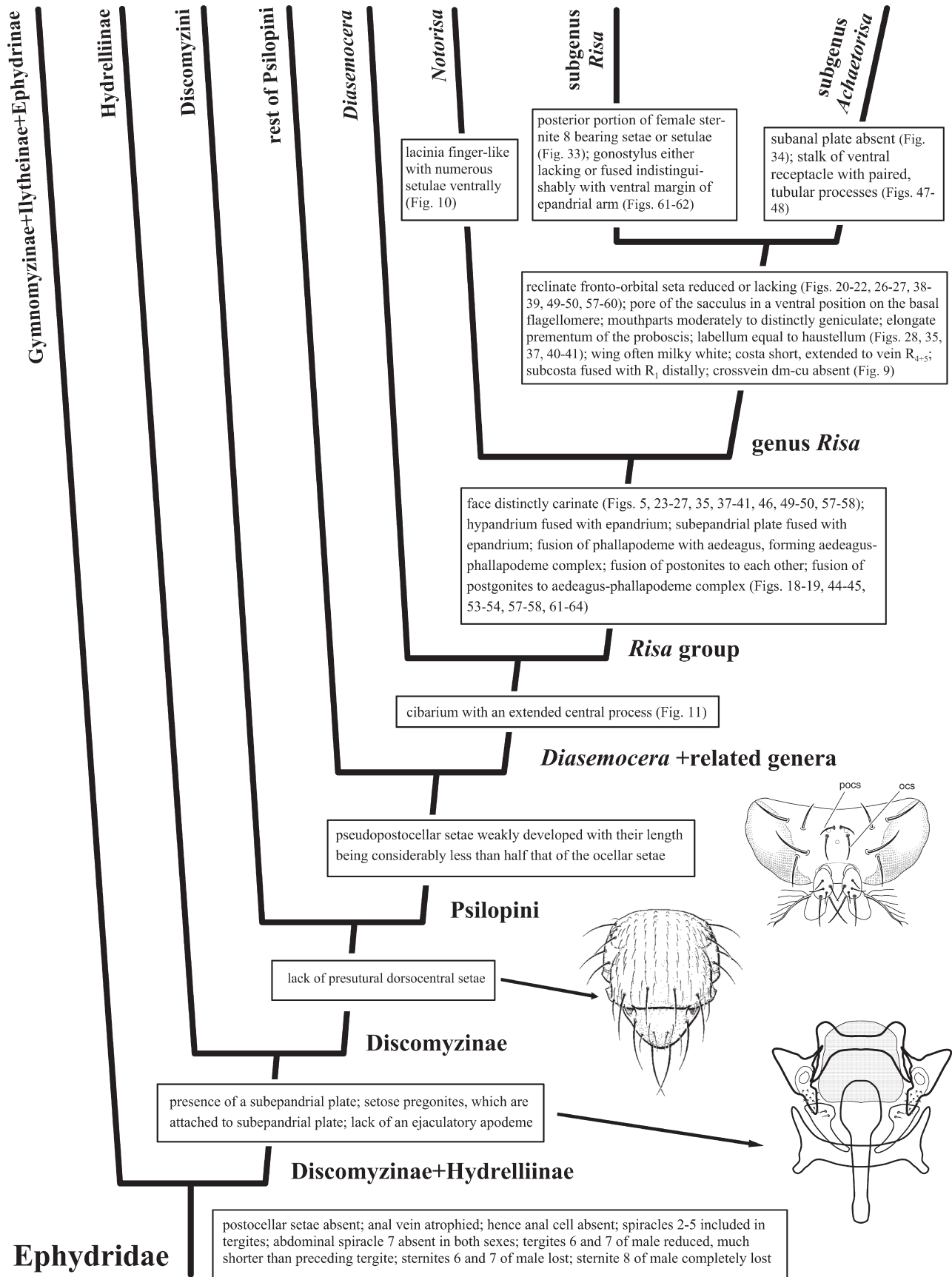


Figure 1. Cladogram and synapomorphies depicting phylogenetic relationships for lineages related to the *Risa* group of genera.

are weakly developed with their length being considerably less than half that of the ocellar setae and the stem of the radial vein lacks setulae.

In this study, we include both external and internal morphological characters, and based on this assessment, we suggest that the *Risa* group of genera is a monophyletic lineage that is also supported by several hypopygial characters: hypandrium fused with epandrium; subepandrial plate fused with epandrium; fusion of phallapodeme with aedeagus, forming aedeagus-phallapodeme complex; fusion of postgonites to each other; and fusion of postgonites to aedeagus-phallapodeme complex.

Within the tribe Psilopini, the *Risa* group is closely related to the genus *Diasemocera* Bezzi. This conclusion is based on the following characters: Seven pseudotracheae

(Fig. 10) and cibarium that are similarly shaped and with an extended central process (Figs 11, 12). Other genera within Psilopini, such as *Clanoneurum* Becker, *Cnestrum* Becker, and *Trimerina* Macquart, have seven pseudotracheae, but these genera have a simple cibarium. Only *Diasemocera* has an elongated cibarial process (Zatwarnicki, 2018).

The other genera referred to above (*Clanoneurum*, *Cnestrum*, *Diasemocera*, and *Trimerina*) also have an association with the plant family Amaranthaceae. For example, *D. leucostoma* (Meigen) has been reared from *Beta vulgaris* L., and most species of *Diasemocera* breed in saline habitats where plants of the genera *Chenopodium* L., *Seidlitzia* L., and *Suaeda* Forsskål proliferate. We acknowledge, however, that specific host-plant information is not presently available for many species.

Key to genera of the *Risa* group

- 1 Costa long, extended to vein M; crossvein dm-cu present (Fig. 8). Mouthparts moderately geniculate, length of labellum slightly more than half haustellum (Figs 5, 10); reclinate fronto-orbital seta well developed, subequal to lateral vertical seta (Figs 3–4, 20) *Notorisa* gen. nov.
- Costa short, extended to vein R₄₊₅; crossvein dm-cu absent (Fig. 9). Mouthparts distinctly geniculate, labellum equal to haustellum (Figs 23–25, 28, 35, 37, 40–41); reclinate fronto-orbital seta reduced or lacking (Figs 21–22) (*Risa* Becker)..... 2
- 2 Face with a medial carina, in lateral view carina rounded; scutellar disc lacking setulae; costal section III (between R₂₊₃ and R₄₊₅) bearing c. 10–35 setulae along anterior margin subgenus *Achaetorisa* Papp
- Face usually with a conspicuous, medial carina, in lateral view carina pointed (carina inconspicuous in *R. kotrbae*); scutellar disc bearing a few, scattered setulae; costal section III (between R₂₊₃ and R₄₊₅) bearing c. 70–80, densely spaced setulae subgenus *Risa* Becker

Notorisa gen. nov.

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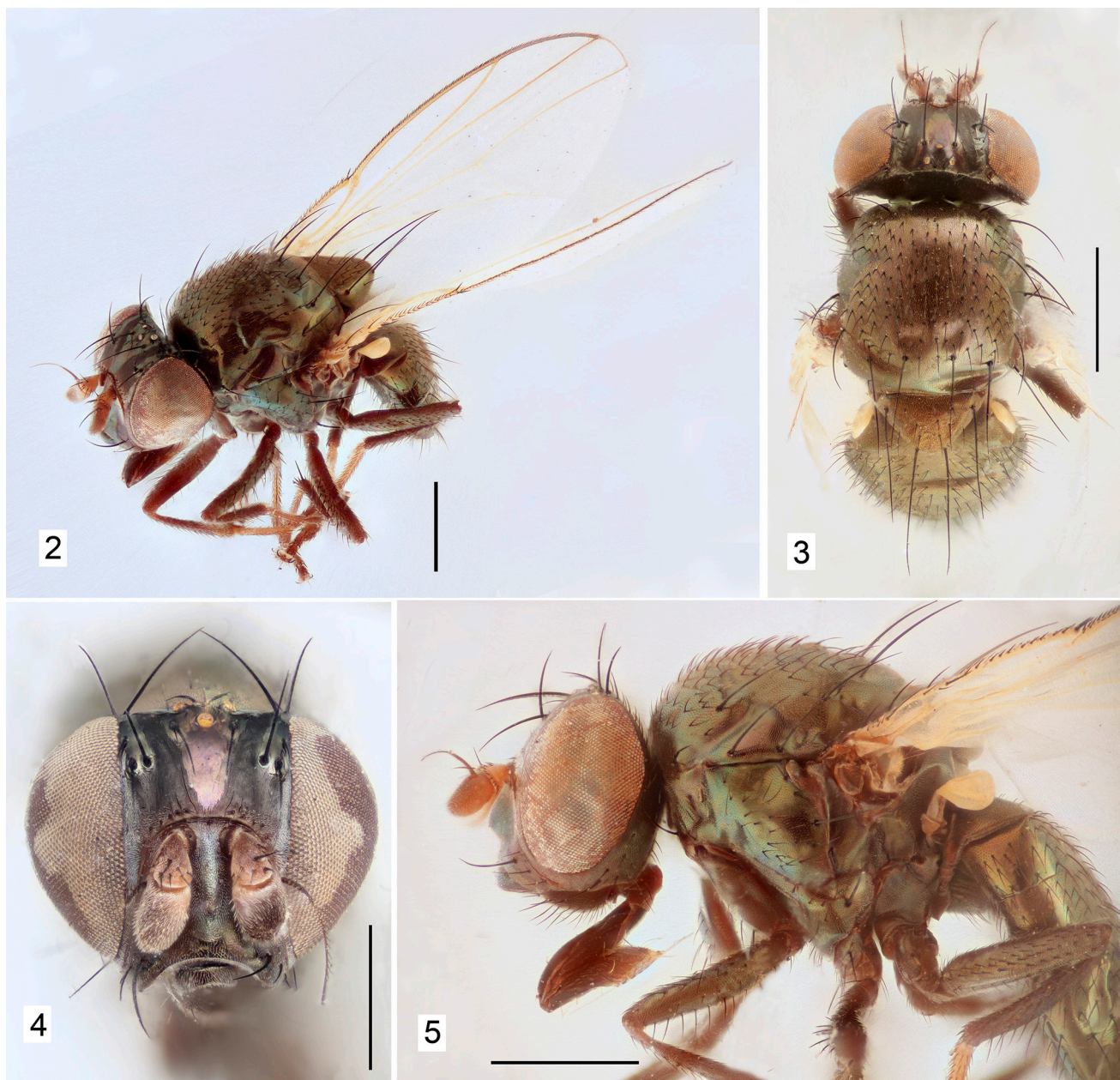
“Genus E”. D. K. McAlpine, 2002: 5–6; 2011: 9–10 [discussion of antennal morphology].

Type species: *Notorisa mcalpinei* sp. nov., by present designation and monotypy.

Diagnosis. Small to moderately small shore flies, body length 1.90–2.80 mm; generally dark colored, shiny (Fig. 2); mouthparts geniculate, with long haustellum and rather short labellum (Figs 5–7); wing venation normal (Fig. 8).

Head: Frons about as high as wide; ocellar triangle long and narrow, extended to anterior margin of frons, shiny (Figs 3, 4); ocellar setae well developed, proclinate, slightly convergent; pseudopostocellar setulae divergent; both medial (= inner) and lateral (= outer) vertical setae well developed; fronto-orbital setae 3, 2 proclinate, with anterior proclinate seta much larger, 3–4 times length of smaller, posterior proclinate seta, 1 large reclinate seta, length subequal to large proclinate seta; frons otherwise with few setulae above and near antennal base (Figs 4, 20).

Antenna moderately elongate (Figs 5–7); antennal ratio about 0.4; basal flagellomere ratio 2–2.5; pedicel lacking a well-developed, spine-like seta anterodorsally; pedicel elongate with lobe on medial side of dorsal seam more prominent than on lateral side; distal articular surface less deeply concave, lacking any suggestion of a cup-like cavity; conus relatively narrow but strongly projected, arising close to medial dorsal lobe; foramen faces laterally; basal flagellomere has no basal stem, basal foramen on a slight scabrous prominence on lateral margin of basal hollow, hollow capacious tilted medially, and its floor with a narrow caecum-like extension; pore of sacculus in a ventral position; beyond base of arista; arista about as long as antenna, rather thick at base, bearing short dorsal hairs. Face vertically carinate (Figs 5, 7), carina produced toward ventral margin as a rounded point; 1 large facial seta near ventral margin; ventral margin of face concave. Clypeus exposed in ventral facial emargination. Gena low, gena-to-eye ratio about 0.8; 1 large genal seta. Eye vertically oval, higher than width, appearing bare of interfacetal setulae. Proboscis geniculate but with length of labellum slightly more than half haustellum; 7 pseudotracheae (Fig. 10); 7 medial sensillae;



Figures 2–5. Photographs of *Notorisa mcalpinei* sp. nov. (2) Habitus, dorso-oblique view. (3) Head and thorax, dorsal view. (4) Head, anterior view. (5) Head and thorax, lateral view. Scale bars = 0.5 mm.

6–7 ventral sensillae (Figs 11, 12); palpus black; lacinia digitiform, bearing numerous setulae ventrally (Fig. 10).

Thorax: Mesonotum generally dark, bronzish black, more golden bronze on scutellum (Figs 2, 3, 6); scutellum as long as wide, not extended over most of abdomen. Chaetotaxy as follows: acrostichal setulae in 5, more or less regular rows and with 1 well-developed, prescutellar pair; only posteriormost dorsocentral seta well developed; 1 postpronotal seta; 1 presutural supra-alar seta; 1 postsutural supra-alar seta; 1 postalar seta; 2 notopleural setae; 2 marginal scutellar setae; 1 proepisternal seta; 1 proepimeral seta; 2 anepisternal setae along posterior margin, ventral seta longer; 1 katepisternal seta (Figs 5, 6). Wing generally hyaline to faintly milky white (Fig. 8), not darkened at base or elsewhere; costa long, extended to apex of vein M; vein R_{4+5} long, reaching costa close to wing tip; wing apex slightly truncate; vein M reaching margin slightly after wing apex;

coloration of all veins similar, yellow to brownish yellow; R stem vein lacking setulae dorsally; crossvein dm–cu present, distinct, mostly straight or shallowly arched, not angulate; costal setulae numerous, arranged in 2 more or less equal rows (anterodorsal and anteroventral rows), extended to vein R_{4+5} . Halter whitish yellow. Coxae, trochanters, femora, and tibiae dark greenish black; tarsi predominantly yellow, becoming brownish on apical 2–3 tarsomeres.

Abdomen: Male with tergites and sternites 1–5 well developed, each tergite with a spiracle in ventral margin; spiracle 6 in membrane adjacent to genital capsule; sternite 2 simple, rectangular with anterior margin even. Male terminalia (Figs 16–19): Epandrium well developed, in lateral view (Fig. 16) widest at midheight, ventral margin rounded; cercus (Figs 16, 17) long and narrow; gonostylus a narrow, moderately wide sclerotized structure beyond ventral margin of epandrium (Figs 16, 17); pregonite a

well-sclerotized structure, wider basally, tapered toward ventral apex; subepandrial plate very shallowly arched, simple, band-like; postgonite clavate, apex rounded, bearing 5–6 setulae; aedeagus and phallapodeme broadly fused at juncture; aedeagus bearing a lateral keel in lateral view (Fig. 19), as a scoop shovel in ventral view (Fig. 18); phallapodeme in lateral view (Fig. 19) with keel long, narrow; hypandrium large, as wide and almost as long as epandrium, pocket-like. Female: Tergites 6–8 narrow, transverse bands; tergites 6–7 bearing several setulae along posterior margin, but not fringe-like; sternites 4–8 subequal in width, bearing numerous setulae; cerci present; subanal plate present (Fig. 13); 8 sternites evident; ventral receptacle large, well developed, sclerotized, with a helmet-shaped operculum and curved stalk, not bearing ventral appendages (Fig. 14); spermathecae and accessory glands reduced to 4 short, delicate, transversely ridged ducts; dorsal wall of vulva with a narrowly V-shaped sclerotized structure, vertex anterior.

Etymology. *Notorisa* is a combination of “notios,” which is Greek for southern, and *Risa*, which is also of Greek derivation and means nose (Becker, 1907:404), in reference to the pronounced facial carina.

Distribution. *Notorisa* is known to occur thus far only on the island continent of Australia, where it is reasonably widespread (see below).

Discussion. This distinctive genus was first noticed by D. K. McAlpine (2002, 2011, = his “Genus E”), who showed us specimens while on a visit to the Australian Museum. David had collected several specimens and had accumulated others, which he set aside as an unusual and probably undescribed genus of shore flies. He had labelled the series with “? Ephydridae.” By good fortune and coincidence, we had begun a study of *Risa* a few months before our field work in Australia and we immediately recognized a close resemblance with *Risa*. We further observed that in many features *Notorisa* is intermediate between *Risa* and other genera of Psilopini, especially those that have an association with Amaranthaceae. Our subsequent, more detailed studies have confirmed that this similarity has a phylogenetic basis, reflecting our proposal of a sister-group relationship.

As noted on the cladogram (Fig. 1) and generic diagnosis above, *Notorisa* is characterized by having a digitiform lacinia that bears numerous setulae ventrally (Fig. 10). The finger-like lacinia is a synapomorphy for *Notorisa*. Other genera in Psilopini, including species of *Risa*, have a narrowed and tapered lacinia.

Notorisa mcalpinei sp. nov.

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Figs 2–8, 10–14, 16–20

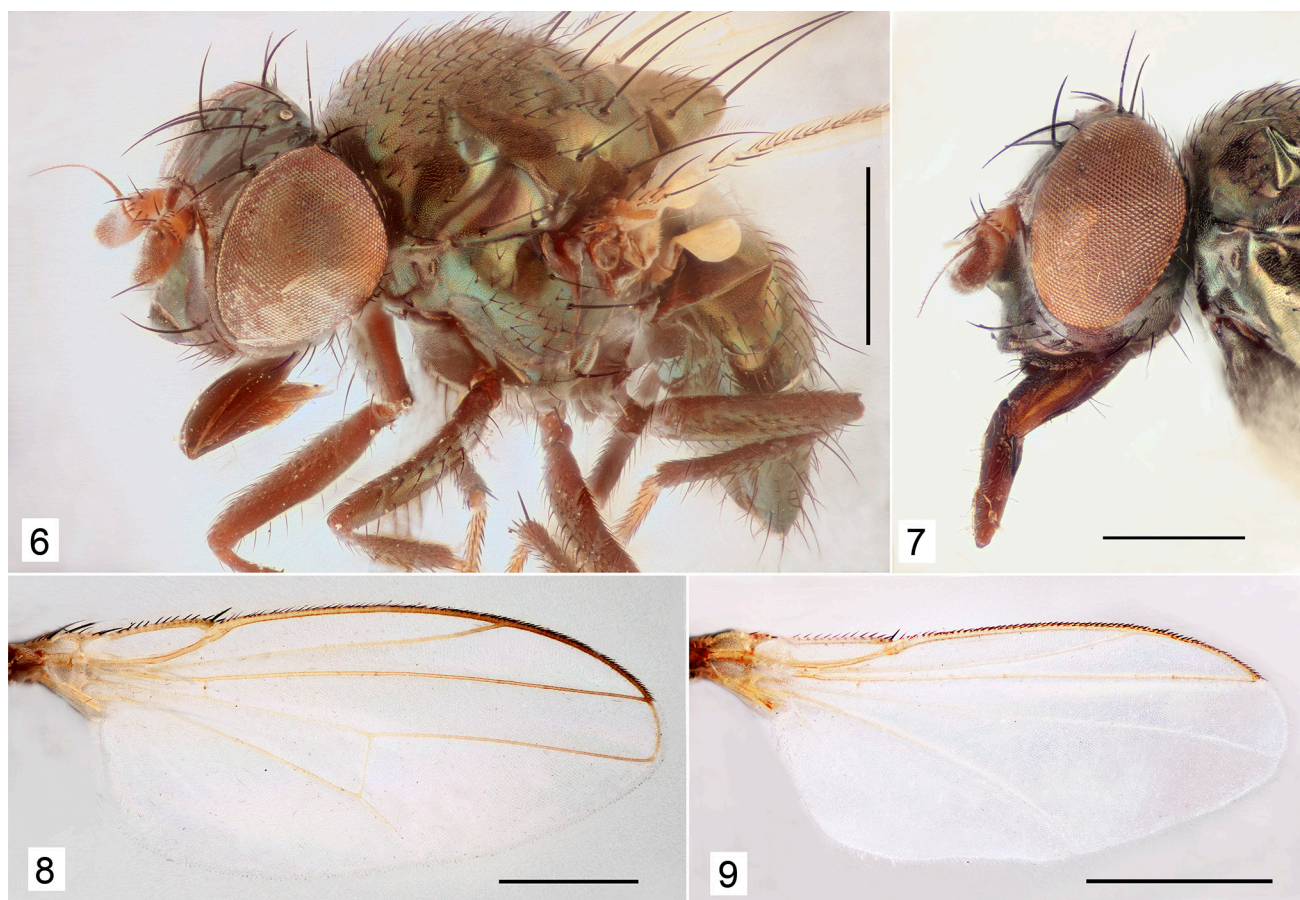
Diagnosis. As in generic description with the following details. Small to moderately small shore flies, body length 1.90–2.75 mm.

Head (Figs 4–7): **Structure:** Frons about as high as wide; ocellar triangle narrow, extended to anterior margin of frons, entirely shiny; fronto-orbits shiny like ocellar triangle; parafrons appearing matt, opaque to subshiny, from some angles whitish gray. Antennal ratio about 0.4; basal flagellomere ratio 2–2.5; arisal hairs short, length of

longest hairs subequal to arisal width at base. Face as high as frons, with prominent carina, carina most prominent at ventral 1/3 of face (Figs 5, 7); face entirely sparsely whitish microtomentose, face shinier ventrally; parafacial densely whitish microtomentose, microtomentum extended dorsally to near base of large fronto-orbital setae and continued posteroventrally with microtomentum on gena and postgena; dorsal portion of occiput sparsely microtomentose, appearing grayish brown. Gena-to-eye ratio 0.09. Labellum usually open, appearing fleshy except for sclerotized base. Labellar ratio 0.8–1.0 in specimens with closed labellum. **Coloration:** Generally bronzish black to black, somewhat shiny (Figs 2–6). Antennal coloration variable, from predominantly brownish yellow to mostly brown, frequently lighter on pedicel and base of basal flagellomere; scape and basal flagellomere mostly brown with some reddish coloration, especially basoventrally; pedicel mostly reddish, somewhat brownish dorsally; palpus black. **Chaetotaxy:** Setae generally well developed; medial-to-lateral vertical setal ratio about 1.0; fronto-orbital setae 3, proclinate setae 2, anterior proclinate seta and reclinate setae well developed, posterior proclinate seta reduced, length about 1/3 larger proclinate seta; 5–6 setulae along anterior margin of frons (Figs 3, 4, 6, 20); face bearing 1 large seta and 2–3 shorter setae usually posteroventrally; gena bearing 1 large seta and several smaller setae (Fig. 7).

Thorax: **Coloration:** Scutum sparsely microtomentose, mostly subshiny, bronzish to golden bronze; halter yellowish white; prescutellar acrostichal setae well developed. **Chaetotaxy:** 2 anepisternal setae; scutellar disc bearing sparse and scattered setulae (Figs 3, 6). **Wing:** costal setulae numerous and dense (more than 40 on distalmost section of costa); wing length 2.15–2.35 mm; costal vein ratio 0.53–0.59; vein M ratio 0.60–0.62. **Legs:** as in generic description.

Abdomen: **Structure:** Sternite 3 rectangular with rounded corners; sternite 4 mostly rectangular, anterior corners flat, making anterior margin trapezoidal; **Coloration:** Strongly and generally bronzish black to black. Male sternites 3–5 longer than wide, sternites 3–4 mostly rectangular, parallel sided; sternite 5 with width of posterior margin twice that of anterior margin, posterior margin shallowly concave, closely associated with anterior margin of hypandrium. Male terminalia (Figs 16–19) as in generic description with these details: Epandrium well developed, in lateral view (Fig. 17) higher than wide, widest at midheight, anterior margin angulate, posterior margin shallowly curved, ventral margin narrowly rounded, in posterior view (Fig. 16) U-shaped; cercus (Fig. 17) in lateral view long and narrow, at least 4 times higher than wide, shallowly curved, in posterior view (Fig. 16) dorsal margin slightly recurved, pointed medially, ventral margin truncate, medial margin with dorsal 2/3 shallowly concave; gonostylus (these paired structures could be terminal portion of epandrium that is now separated by an unsclerotized gap) free at ventral margin of epandrium, in lateral view (Fig. 17) slender, shallowly curved, bearing 5–7 setulae, in posterior view (Fig. 18) longer than wide, apical 2/3 tapered to narrowed apex; pregonite a well sclerotized structure, in lateral view (Fig. 19) with basal and apical position both evenly tapered to acute point, both slightly curved, apical half recurved, bearing a few setulae in recurved margin, apical 1/3 digitiform, bearing tiny setulae along shallow concavity, in ventral view (Fig. 18) with medioapical margin truncate,



Figures 6–9. Photographs of *Notorisa mcalpinei* sp. nov. (6–8) and *Risa longirostris* Becker (9). (6) Head, thorax and abdomen, antero-oblique view. (7) Head, lateral view. (8) Wing. (9) Wing. Scale bars = 0.5 mm.

thereafter toward base somewhat rectangular, basal portion narrowed to acute, basal apex; subpandrial plate in lateral view (Fig. 19) narrow, basal $\frac{2}{3}$ nearly straight, apical third angled posteriorly, in ventral view (Fig. 18) irregularly quadrate, lateral sides narrow, angulate, posterior margin with lateral angles produced laterally as short, tapered, acutely pointed; anterior margin widely and evenly truncate; secondary process attached to latero-anterior margin of subpandrial plate robustly digitiform, longer than wide, bearing 9–11 short setulae; aedeagus and phallapodeme fused, aedeagal portion in lateral view (Fig. 19) irregularly triangular, tapered to point, phallapodemal portion gently arched posteriorly, broadly rounded apically, with a short, digitiform projection at midheight, in ventral view (Fig. 18) aedeagus broadly oval, apical margin broadly rounded, posterior narrowed, phallapodemal portion dagger-like; postgonites ovate, bearing 4–6 setulae; hypandrium in lateral view (Fig. 19) with length over twice width, anterior margin rounded, posterior margin irregularly linear with angulate depressions. Female: tergites 6–7 bearing several setulae along posterior margin, but not fringe-like; tergite 8 less sclerotized dorsolaterally; sternite 8 more or less pentagonal (length/width ca 0.7) with obtusely pointed apex directed anteriorly (Fig. 13), more strongly sclerotized along anterior margin, with anteromedial protrusion that bears 12–13 short, stout, black, sometimes knob-like setulae; posterior margin very shallowly concave; posterior and laterad of protrusion bearing numerous setulae with 1 larger, submarginal pair; subanal plate present, shallowly V-shaped, bearing some

setulae; ventral receptacle with a helmet-shaped operculum and curved stalk, not bearing ventral appendages (Fig. 14); cerci short, rounded, bearing several setulae and 1 large pair of setulae inserted anteriorly (adjacent to a structure that appears like a double setal base without a seta); medial margin of cerci sharply defined.

Type material. The holotype male of *Notorisa mcalpinei* is labelled “VIC:nr Lake Hindmarsh[,] Big Desert Nat[ional; Wilderness] P[ar]k[, 35°42.6'S 141°03.7'E] 29–30 Nov. 1992/Moulds, [D. K.] McAlpine, McEvey/HOLOTYPE ♂ *Notorisa mcalpinei* Mathis & Zatwarnicki AM [red].” The holotype is double mounted (minuten in rectangular block of polyporus), is in excellent condition, and is deposited in the Australian Museum (K.612148). Eleven other paratypes (3♂, 8♀; 6 in AM, K.612149–K.612154, and 5 in USNM) bear the same locality label as the holotype. Other paratypes are as follows: AUSTRALIA. Australian Capital Territory: Black Mountain (Light Trap; 35°16.7'S 149°06.5'E), 11 Sep 1963, I. F. B. Common (1♀; ANIC). Canberra (35°16.9'S 149°01.7'E), 18 Oct 1955, I. F. B. Common (2♀; ANIC).

Other material examined.—New South Wales: Broken Hill (40 km SE, 32°11'S 142°03'E), 28 Sep 1975, Z. Liepa (1♂, 1♀; ANIC). Goonoo S. F. (6 km SW Mendooran [31°51'55"S 149°05'49"E]; light), 6 Apr 1979, B. J. Day, D. K. McAlpine (1♀; AM). Hazel Dell Station via Menindee (32°43.2'S 143°18.3'E), 21 Sep 2004, G. Curran (4♀; ANIC). Lachlan River (15 km SW of Euabalong; 33°13.6'S 146°22.2'E), 28 Dec 1976, Z. Liepa (1♂; ANIC). Menindee Lakes (32°17.5'S 142°22.3'E), 26 Sep 1975, Z. Liepa (2♂, 5♀; ANIC). Trangie (32°02'S 147°58.9'E), 21 Oct 1949,



Figures 10–15. Photographs of *Notorisa mcalpinei* sp. nov. (10–14) and *Risa longirostris* Becker (15). (10) Proboscis, lateral view. (11) Labrum, posterior view. (12) Cibarium, posterior view. (13) Terminal female abdominal segments, ventral view. (14) Ventral receptacle, lateral view. (15) Ventral receptacle, lateral view. Scale bars = 0.2 mm (10–11), = 0.1 mm (12–13), = 0.05 mm (14–15).

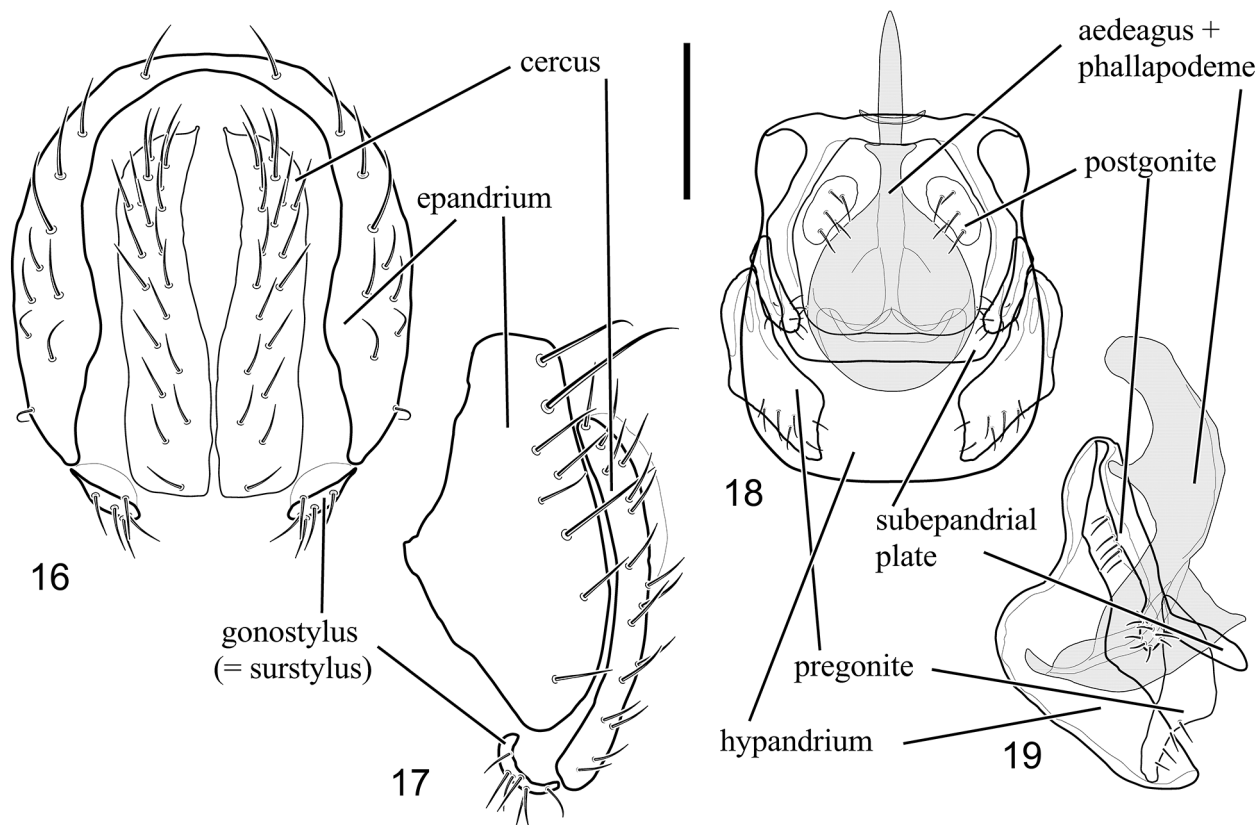
S. J. Paramonov (1♀; ANIC). Wanaaring (96 km W; 29°43.4'S 143°05.2'E), 30 Oct 1949, S. J. Paramonov (1♀; ANIC). Wilcannia (64 km E; 31°35.7'S 144°54.8'E), 23 Nov 1949, S. J. Paramonov (1♀; ANIC).

Northern Territory: Brunette Downs (40 km S; 18°53.3'S 136°04.2'E), 11 Apr 1976, D. H. Colless (1♀; ANIC).

Queensland: Barcaldine (30 km S, on road; 23°48.8'S 145°17.5'E), 10 Nov 1981, D. H. Colless (2♀; ANIC). Boulia (25 km NW by N; at light; 22°45.2'S 139°51.8'E), 8 Apr 1976, D. H. Colless (1♀; ANIC). Carnarvon National Park, Mt. Moffatt Section (3 km SE headquarters; 25°04.6'S 148°0.5'E; 740 m), 18–19 Nov 1995, M. E. Irwin, S. D. Gaimari (5♂; INHS). Carnarvon National Park, Mt. Moffatt Section (headquarters; 25°01.3'S 147°57.3'E; 740 m), 18 Nov 1995, M. E. Irwin, S. D. Gaimari (1♂, 6♀; INHS). Carnarvon National Park, Mt. Moffatt Section (24°58.1'S 147°57.2'E; 760 m), 19–20 Nov 1995, M. E. Irwin, S.

D. Gaimari (1♂; INHS). Carnarvon National Park, Mt. Moffatt Section (near mailboxes; 25°02.1'S 147°54'E; 720 m), 19–20 Nov 1995, M. E. Irwin, S. D. Gaimari (1♂; INHS). Chillagoe (6 km SE; at light; 17°36'S 144°18'E), 26 Nov 1981, D. H. Colless (2♂, 4♀; ANIC). Nocundra (near; 27°44.2'S 142°41.3'E), 13 Nov 1949, S. J. Paramonov (1♂, 1♀; ANIC). Tickalarra (32 km S; 28°38.3'S 142°12.5'E), 15 Nov 1949, S. J. Paramonov (1♀; ANIC).

South Australia: Blinman (10.5 km NW; 31°05.4'S 138°40.3'E), 4 Oct 1975, Z. Liepa (3♀; ANIC). Hawker, Torrens Rd. (32 km NW; 31°47.3'S 144°18'E), 2 Oct 1975, Z. Liepa (3♂, 4♀; ANIC). Mallee, Meningie (35°41.4'S 139°20.2'E), 7 Nov 1988, B. J. Day, D. K. McAlpine (2♂; AM). Oodnadatta (33 km SE by S; 27°35.9'S 135°27.4'E), 23 Sep 1972, Z. Liepa (1♂, 1♀; ANIC). River Clayton (50 km NE by N Marree; 29°16.7'S 138°22.3'E), 16 Sep 1972 (1♂; ANIC). The Coorong (30 km S Meningie; 35°57.2'S 139°31.6'E), 8 Dec 1977, D. K. McAlpine, M. A. Schneider (1♀; AM).



Figures 16–19. Male terminalia of *Notorisa mcalpinei* sp. nov. (16) Epandrium, cerci, gonostylus, ventral view. (17) Same, lateral view. (18) Internal structures (postgonite, hypandrium and aedeagus fused with phallapodeme), ventral view. (19) Same, lateral view. Scale bar = 0.1 mm.

Victoria: Hattah (2 km E; 34°45.9'S 142°22.2'E), 21 Nov 1975, K. R. Norris (2♀; ANIC). Lake Hindmarsh (near), Big Desert National Park (36°03.7'S 141°54.8'E), 29–30 Nov 1992, D. K. McAlpine (3♂, 6♀; AM). Lake Kenyon, Murray-Sunset National Park (35°02.7'S 141°44.4'E), 26 Nov 1992, D. K. McAlpine (1♀; AM). Melbourne, Mill Park (37°40.2'S 145°04.3'E), Nov 1978, I. R. Bock (1♀; AM). Mt. Cowra (10 km WNW), Murray-Sunset National Park, Dry Lake (35°02.5'S 141°43.2'E), 26 Nov 1992, D. K. McAlpine (2♀; AM). Pink Lakes (73 km W Ouyen; 35°02.8'S 141°48.4'E), 13 Oct 1975, Z. Liepa (1♀; ANIC). Rocket Lake (5 km S; 34°38.4'S 141°48.5'E), Murray-Sunset National Park (34°39'S 141°49'E), 25 Nov 1992, D. K. McAlpine, S. F. McEvey, B. J. Moulds (1♂; AM).

Western Australia: Broome (101 km SE by E; 18°16.2'S 123°01.8'E), 20 Aug 1976, I. F. B. Common (1♂; ANIC). Dongara (3.2 km SSW; 29°15.5'S 114°55.3'E), 15 Oct 1970, D. H. Colless (2♀; ANIC). Dunham River (100 km S Wyndham; 16°15.4'S 128°09.2'E), 3 Jan 1986, M. S. and B. J. Moulds (1♀; AM). Junana Rock (33°23'S 123°24'E), 27–29 Oct 1977, D. H. Colless (Melaleuca blossom (2♂; ANIC). Mount Ragged (at light; 33°27.1'S 123°28.4'E), 30 Oct 1977, D. H. Colless (1♂, 1♀; ANIC). Murchison River (25°52.7'S 118°50.3'E), 27 Mar 1971, Upton & Mitchell (3♂, 3♀; ANIC). Thomas River estuary, Esperance District (24°49.8'S 113°47.2'E), 4 Nov 1977, D. H. Colless (1♀; ANIC), H. Colless (1♂, 3♀; ANIC). Watheroo (30°18'S 116°03.4'E), 15 Oct 1970, D. H. Colless (1♂, 3♀; ANIC).

Type locality. Australia. Victoria. Big Desert Wilderness Park, near Lake Hindmarsh (36°03.7'S 141°54.8'E).

Distribution. Australasian/Oceanian: Australia (ACT, NSW, QLD, SA, VIC, WA).

Etymology. The species epithet, *mcalpinei*, is a genitive patronym to honor David K. McAlpine, collector of most of the type series. We take great pleasure in recognizing David's many contributions to the study of Diptera, especially families within Schizophora.

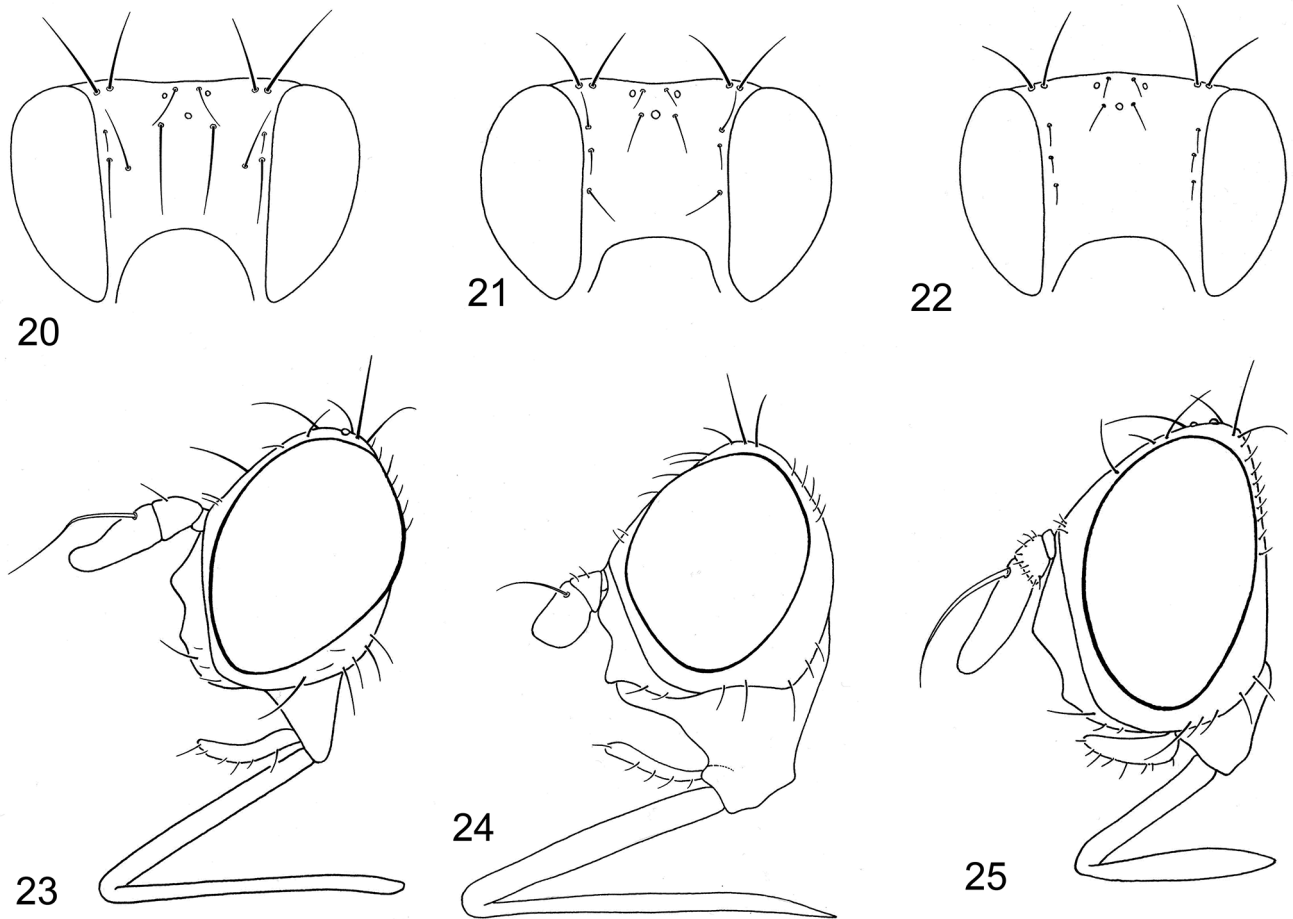
Remarks. As with *Risa*, we suggest the possibility that this species may be associated with plants of the family Amaranthaceae.

Genus *Risa* Becker

Risa Becker, 1907:404. Type species: *Risa longirostris* Becker, 1907:404 [monotypy]. Hennig, 1937:75 [redescription]. Papp, 1984: 178 [Palearctic catalogue]. Griffiths, 1990: 128 [phylogenetic discussion]. Mathis & Zatwarnicki, 1998:550 [generic key]. Kotrba & Mathis, 2009: 627–640 [morphology of female terminalia]. D. K. McAlpine, 2002: 5–6; 2011: 9–10 [antennal morphology].

Diagnosis. Minute to small shore flies, body length 0.95–1.60 mm; generally dark colored, shiny; mouthparts geniculate, moderately to extremely long; wing venation reduced.

Head: Generally bluish black to black, somewhat shiny (Figs 26, 27, 35, 37–41, 49, 50, 57–60). Frons generally black, shiny; ocellar triangle long and narrow, extended to anterior margin of frons; ocellar setae well developed, proclinate, slightly divergent; pseudopostocellar setulae divergent; both medial and lateral vertical setae well developed; fronto-orbital setae 2–4, usually 3, orientation various: in most species all fronto-orbital setae proclinate



Figures 20–25. Line drawing of frons and associated setae, dorsal view. (20) *Notorisa mcalpinei* sp. nov. (21) *Risa longirostris* Becker. (22) *R. asiatica* Ozerov. (23–25) Line drawing of head, lateral view. (23) *R. longirostris* Becker. (24) *R. brevicornis* Papp. (25) *R. longicornuta* Papp.

(Figs 21, 22, 35–41, 46, 49, 50, 57–60), small, hair-like, subequal (“similar” in text hereafter); in some species anterior fronto-orbital seta about 2–3 times longer than middle seta, inclinate, posterior seta usually reclinate (“dissimilar” in text hereafter; *R. flavipalpis* is intermediate), frons otherwise with few setulae above and near antennal base. Antenna short to moderately elongate; antennal ratio $\frac{1}{3}$ – $\frac{2}{3}$; basal flagellomere ratio varying from only slightly greater than 1:4; usually predominantly yellow, frequently brownish dorsoapically; pedicel elongate with lobe on medial side of dorsal seam more prominent than on lateral side; distal articular surface less deeply concave, lacking any suggestion of a cup-like cavity; conus relatively narrow but strongly projected, arising close to medial dorsal lobe; foramen faces laterally; basal flagellomere has no basal stem, basal foramen on a slight scabrous prominence on lateral margin of basal hollow, hollow capacious tilted medially, and its floor with a narrow caecum-like extension; pore of sacculus in a ventral position; beyond base of arista; pedicel lacking a well-developed, spine-like seta anterodorsally; arista about as long as antenna, rather thick at base, bearing short to very short, dorsal hair-like branches. Face vertically carinate, carina prominent to shallow, in lateral view sharp to rounded (Figs 23–27, 35–41, 46, 49, 50); facial seta 1; ventral facial margin arched. Eye vertically oval, higher than wide, appearing bare. Gena short; 1 genal seta. Clypeus not exposed. Proboscis geniculate, rostrum elongate (Figs 23–25), haustellum and

labellum equal in length, but labellar ratio variable among species; 2–3 pseudotracheae, these short, at apex of labellum (Figs 31, 32); cibarium with 2 medial sensillae (Fig. 29) and no ventral sensillae; palpus black or yellow.

Thorax: Mesonotum generally dark bluish or greenish black to black; scutellum wider than long. Chaetotaxy as follows: Acrostichal setulae in 2 irregular rows (Figs 39, 59, 60), sometimes with 1 well-developed, prescutellar pair; only posteriormost dorsocentral seta well developed; 1 postpronotal seta; 1 presutural supra-alar seta; 1 postsutural supra-alar seta; 1 postalar seta; 2 notopleural setae; 2 marginal scutellar setae; 1 proepisternal seta, 1 proepimeral seta, 1–2 anepisternal setae, one or both along posterior margin, if 2, ventral seta longer; 1 katepisternal seta (Fig. 60). Wing generally milky white, not darkened at base or elsewhere; costa short, extended to apex of vein R_{4+5} ; vein R_{2+3} well separated from costa; vein R_{4+5} short, reaching costa far anterior of wing tip; vein M reaching wing tip or slightly posterior; R stem vein lacking setulae dorsally; veins M and CuA_1 colorless; crossvein dm–cu absent (Fig. 9); costal setulae arranged in 2 more or less equal rows (anterodorsal and anteroventral rows). There are either less and sparser setulae (up to about 35 along distalmost section of costa), or setulae are numerous and dense (more than 40 on distalmost section of costa). Halter variable, whitish yellow to blackish. Coxae, trochanters, and femora dark brown to black except apices of femora usually yellow; tibiae centrally

usually brown to black but extent of dark coloration varies between legs as well as inter- and intraspecifically; mid- and hindtibiae usually more extensively dark than foretibia; tarsi yellow.

Abdomen: Generally dark bluish or greenish black to black, sometimes partly orange basally. Male: Tergites and sternites 1–5 well developed, each tergite with a spiracle in ventral margin; spiracle 6 in membrane adjacent to postabdomen; sternite 2 notched or excavated along anterior margin or distinctly Y-shaped, with arms of bifurcation oriented anteriorly. Male terminalia: Epandrium as an inverted U, narrowed dorsally, band-like, lateral arms becoming wider ventrally (Figs 42, 51, 61); cercus elongate, bacilliform, setulose, sometimes somewhat fused ventrolaterally with medial margin of epandrium; gonostylus well developed (Figs 51, 55) or fused with ventral margin of epandrium (Figs 61, 62); pregonite attached to subepandrial plate, variously developed, short or long, narrow, sharply pointed apically; subepandrial plate partially attached to underside of epandrium; postgonite attached to aedeagus-phallapodeme complex, mostly rounded (Figs 44, 45, 53, 54, 63, 64), sometimes with narrow process, bearing 3–4 setulae (Figs 63, 64); aedeagus and phallapodeme broadly fused at juncture; aedeagus a simple tube, rounded apically; phallapodeme short, lacking extended keel; hypandrium well developed, attached posterolaterally to epandrium, broad, emarginate medially at base, shallowly concave, sometimes weakly sclerotized (Figs 44, 45, 53, 54, 63, 64). Female terminalia: Subanal plate absent; sternite 8 entire but lacking a sclerotized, protrusion, posterior portion lacking hooked setulae, but bearing 12–22 short, straight setae along anterior margin; cerci short and rounded (Fig. 33); stalk of ventral receptacle with (Figs 47, 48) or without (Fig. 15) paired, tubular processes.

Distribution and natural history. *Risa* is strictly an

Old World genus, now comprising ten described species. The geographic range for the genus extends from Spain and Morocco eastward across North Africa and Israel to Mongolia in the far east. The genus seems to be restricted to arid regions where it is associated with host plants of the family Amaranthaceae.

Discussion. The female terminalia of *Risa* are peculiar and are a primary source of evidence, supporting the inclusion of this genus in the Ephydriidae. This combination of characters is not known to occur in any other family of Schizophora. In freshly pinned material it is possible to see a row of white hairs that requires high magnification for clarification of its structure (SEM?). The structure and sclerotization of the female terminalia are such that even in shriveled specimens the apex of the abdomen is exposed and more or less in a natural position. In shriveled males, the lateral margins of the abdomen fold such that the abdomen appears triangular and the terminalia are hidden behind the folds.

The monophyly of *Risa* is corroborated by the following characters that are mostly synapomorphies (many of these characters were identified previously by Griffith, 1972; D. K. McAlpine, 2002, 2011): Head: Recline fronto-orbital seta reduced or lacking; pore of the sacculus in a ventral position on the basal flagellomere; face distinctly carinate, sometimes carina somewhat pointed; mouthparts moderately to distinctly geniculate; elongate prementum of the proboscis; labellum equal to haustellum. Thorax: Wing often milky white; costa short, extended to vein R_{4+5} ; subcosta fused with R_1 distally; crossvein dm–cu absent.

The proboscis in species of *Risa* is elongated, which is apparently an adaptation to nectar feeding as adults. Similar adaptations of the proboscis have developed in the Milichiidae, hence the placement of *Risa* by some authors in this family (see illustrations and descriptions in the seminal work of Brake, 2000).

Key to species of *Risa* Becker

- 1 Palpus yellow 2
- Palpus black 3
- 2 Forecoxa black. Ocellar triangle short, slightly protruding beyond middle of frons. Postocellar setae present *R. flavipalpis* Ozerov
- Forecoxa yellow. Ocellar triangle long, reaching lunule. Post-ocellar setae absent *R. flavicoxa* Krivosheina & Ozerov
- 3 Fronto-orbital setae 3 (rarely 2 or 4), proclinate, small, hair-like, equal or subequal in size (Figs 22, 38, 39, 49, 50, 57–60) 4
- Anterior fronto-orbital seta about 2–3 times longer than middle fronto-orbital seta, inclinate; posterior fronto-orbital seta usually reclinate, occasionally proclinate, usually as long as anterior fronto-orbital setae, occasionally as long as middle fronto-orbital seta (Figs 21, 26, 27) 9
- 4 Labellum about twice length of ventral margin of head in lateral view (Figs 24, 46) 5
- Labellum about 1–1.5 times length of ventral margin of head (Figs 23, 25, 40, 41, 58) 8

- 5 Prescutellar acrostichal setae well developed; scutellar disk bearing scattered, sparse setulae; setulae along costal margin numerous; large species (length about 2 mm) *R. asiatica* Ozerov
- Prescutellar acrostichal setae greatly reduced or lacking (Fig. 37, 59–60); scutellum lacking setulae; setulae along costal margin sparse; smaller species (length about 1–1.5 mm) 6
- 6 Scutum distinctly microtomentose; setulae along costal margin more numerous and denser (24–34 on distalmost section). Halter knob with large dark spot *R. brevicornis* Papp comb. nov.
- Scutum indistinctly microtomentose; setulae along costal margin fewer and sparser (11–16 on distalmost section). Halter knob entirely yellow or with large dark spot 7
- 7 Antenna and arista predominantly brownish (Fig. 37). Halter knob yellow *R. salsolae* (Mathis & Zatwarnicki) comb. nov.
- Antenna predominantly or entirely yellow, scape and pedicel and basal flagellomere anteroapically occasionally darker, arista yellow to brown (Figs 49, 50). Halter knob with large dark spot *R. nettae* sp. nov.
- 8 Face nearly flat, without prominent shallow/low carina (Fig. 58); antenna elongate, basal flagellomere ratio 1.75; scutum distinctly microtomentose (Figs 59, 60); lower portion of frons, parafacial and lateral margin of face conspicuously and finely whitish to silvery microtomentose (Figs 57, 60) *R. kotrbae* sp. nov.
- Face with distinct carina (Figs 38, 39); antenna short, basal flagellomere ratio 1; scutum practically without microtomentum; lower position of frons, parafacial and lateral margins of face almost bare of microtomentum, shiny (Figs 38, 39) *R. brevirostris* sp. nov.
- 9 Proboscis short, labellum about 1.25 times length of ventral margin of head (Fig. 25); antenna elongate, basal flagellomere ratio 2.5–3 (Fig. 25) *R. longicornuta* Papp
- Proboscis long, labellum about 1.5 times length of ventral margin of head (Figs 23, 40, 41); antenna shorter, basal flagellomere ratio 2 (Figs 23, 26, 27) *R. longirostris* Becker

Subgenus *Achaetorisa* Papp

Achaetorisa Papp, 1980: 420, 421 [as a genus]. Type species:
Achaetorisa brevicornis Papp, 1980: 421 [monotypy];
1984: 178 [Palearctic catalog].

Diagnosis. The subgenus *Achaetorisa* is distinguished from the nominate subgenus *Risa* by the following combination of characters: *Head*: Face with a medial carina, in lateral view carina rounded.

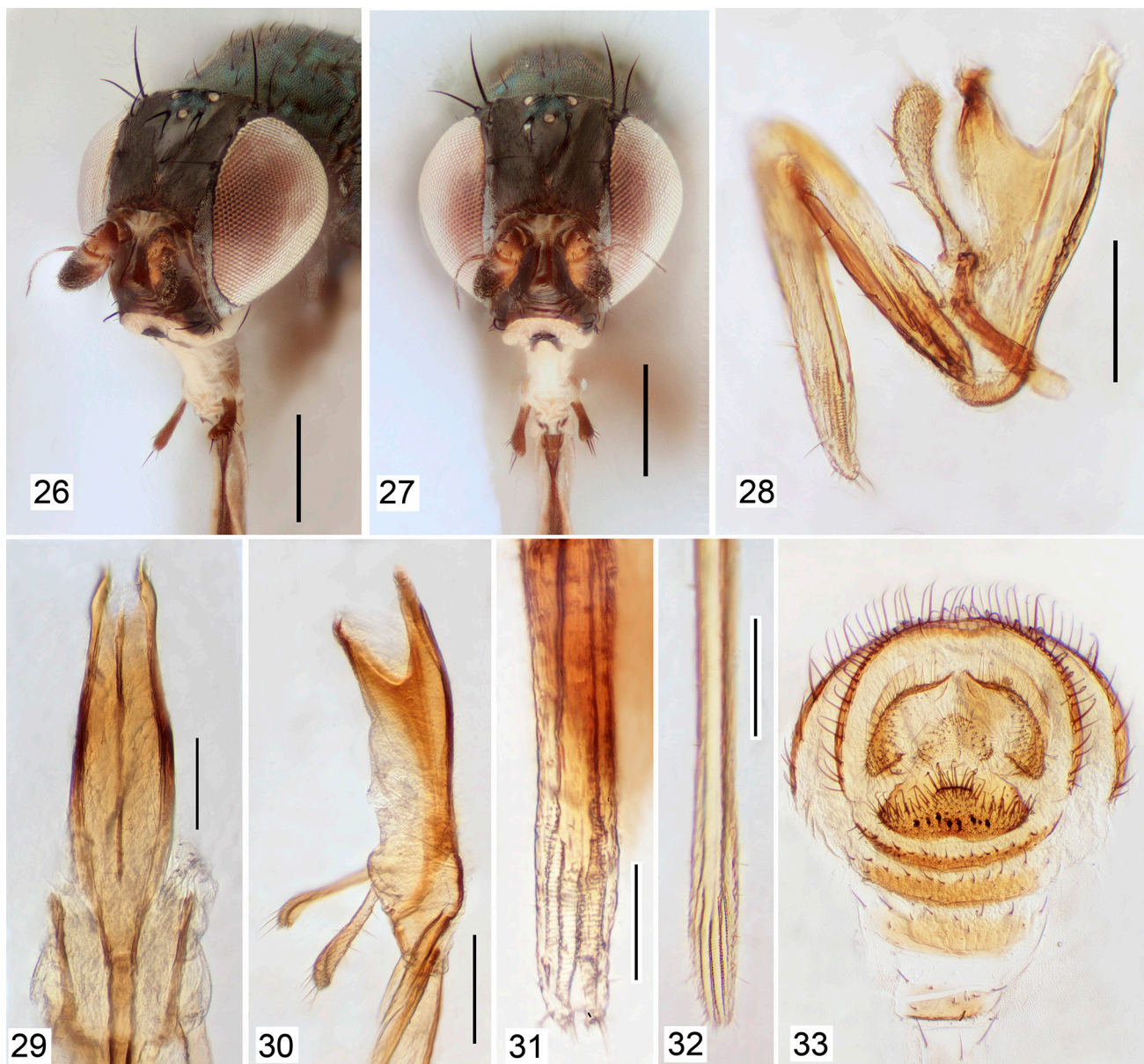
Thorax: Prescutellar acrostichal setae absent, only setulae present; scutellar disc lacking setulae. Costal section III (between R_{2+3} and R_{4+5}) bearing approximately 10–35 setulae along anterior margin.

Abdomen: Male terminalia: Cercus elongate, separate from epandrium; gonostylus evident as distinct lobe at ventral margin of epandrial arm (Figs 42, 55); hypandrium in ventral view plate like, longer than wide, shallowly pocket-like. Female terminalia: subanal plate absent (Fig. 34); sternite 8 entire but lacking a sclerotized, protrusion, posterior portion lacking hooked setulae, but bearing 12–22 short, straight setae along anterior margin; cerci short and rounded; stalk of ventral receptacle with paired, tubular processes (Figs 47, 48).

Discussion. *Achaetorisa* is given status here as a well-corroborated, monophyletic subgenus. As a terminal clade, however, its recognition as a subgenus leaves the nominate subgenus as a paraphyletic group that includes, among other lineages, *Achaetorisa*.

Papp (1980) described *Achaetorisa* and distinguished it from *Risa* using several characters. The discovery of additional species of *Risa*, and thus an enhanced opportunity to study critically characters for this group, revealed that *Achaetorisa brevicornis* is congeneric with other species of *Risa* and that *Achaetorisa* should therefore be consigned to subgeneric status within *Risa*. Papp (1980), however, did not emphasize the distinctive and paired ventral appendages of the female ventral receptacle in *R. brevicornis*. These appendages appear to be unique to the *Achaetorisa* group.

We recognize the following five species in the subgenus *Achaetorisa*: *Risa (Achaetorisa) brevicornis* (Papp) comb. nov., *R. (A.) brevirostris* sp. nov., *R. (A.) flavicoxa* Krivosheina & Ozerov, *R. (A.) nettae* sp. nov., and *R. (A.) salsolae* (Mathis & Zatwarnicki) comb. nov.



Figures 26–33. Photographs of *Risa longirostris* Becker (26–27, 29–31, 33) and *Risa brevirostris* sp. nov. (28, 32). (26) Head, antero-oblique view. (27) Same, anterior view. (28) Proboscis, lateral view. (29) Rostrum, anterior view (microscopic photograph). (30) Same, lateral view. (31) Labellum, posterior view. (32) Labellum, anterior view. (33) Terminal female abdominal segments, anterior view. Scale bars = 0.2 mm (26–27), = 0.1 mm (28–30, 33), = 0.05 mm (31–32).

***Risa (Achaetorisa) brevicornis*
Papp comb. nov.**

Figs 24, 35

Achaetorisa brevicornis Papp, 1980: 421 [Morocco. Marrakech: Ouirgane (31°11.7'N 08°4.4'W); HT ♂, USNM]; 1984: 178 [Palearctic catalog].

Achaetorisa salsolae Mathis & Zatwarnicki, 2017: 646 [United Arab Emirates. Ajman (N; 25°25.7'N 55°30.1'E; salt marsh); HT].

Distribution. Palearctic: Israel/Jordan, Morocco, Spain.

Natural history. This species is associated with *Halogeton sativus* (L.) Moq. (Amaranthaceae).

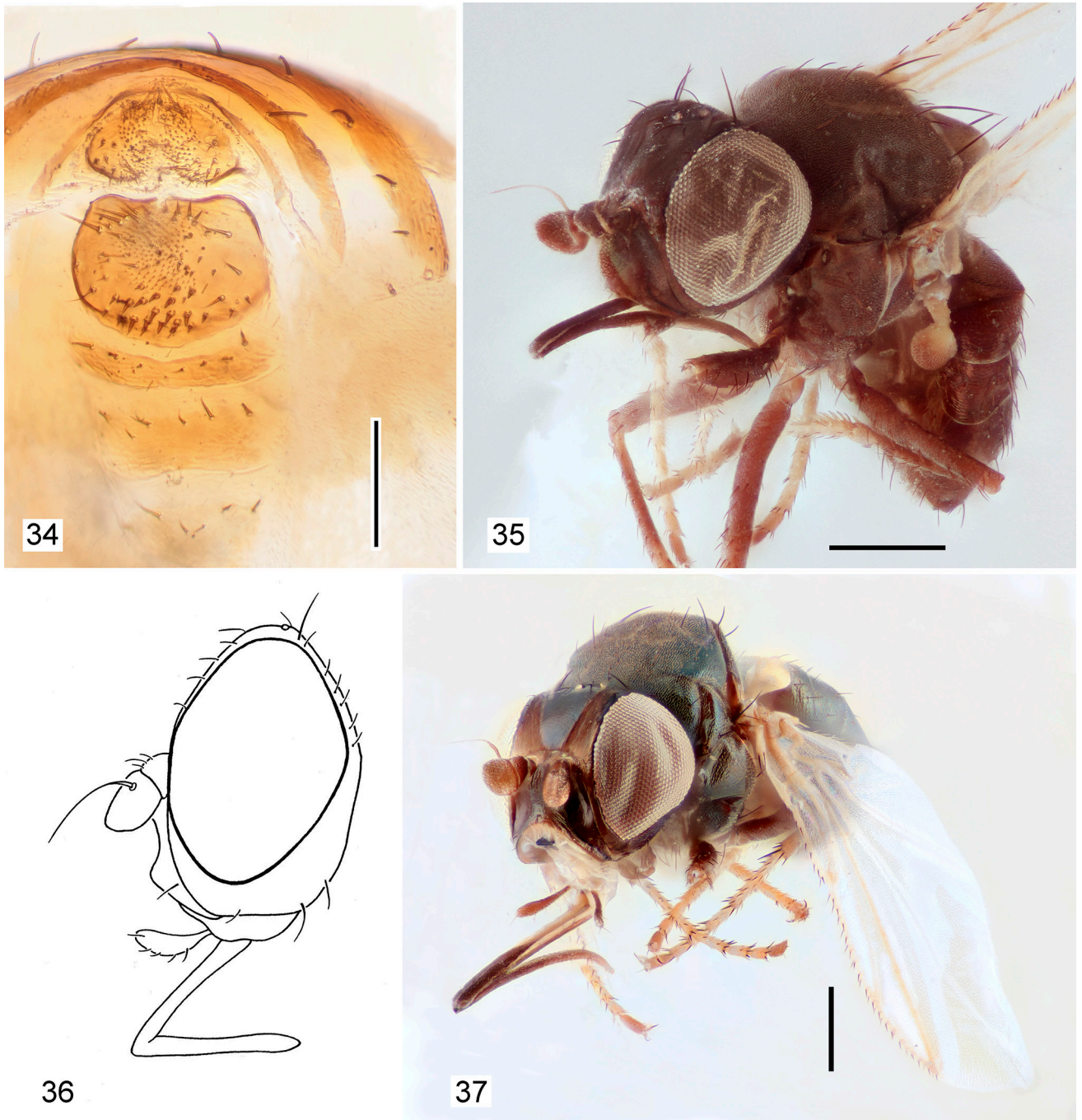
***Risa (Achaetorisa) brevirostris* sp. nov.**

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Figs 28, 32, 34, 38, 39, 42–45

Diagnosis. This species is distinguished from congeners by the following combination of characters: Small shore flies, body length 1.48–1.70 mm.

Head: *Structure:* Face moderately low, with prominent carina (Figs 38, 39); antennal ratio $\frac{1}{3}$ – $\frac{2}{5}$; basal flagellomere ratio 1.5; arisal hairs very short; labellar ratio about 1 (Fig. 28). *Coloration:* Antenna as for genus; palpus black; head otherwise black, without distinct microtomentum. *Chaetotaxy:* Medial-to-lateral vertical setal ratio 2; fronto-orbital setae 3 (rarely 2 or 4), proclinate, small, hair-like, equal or subequal in size (Figs 38, 39).



Figures 34–37. Line drawing and photographs of *Risa*. (34) Terminal female abdominal segments of *R. breviostris* sp. nov., anterior view. (35) Habitus of *R. brevicornis* (Papp), antero-oblique view. (36) Head of *R. breviostris* sp. nov., lateral view. (37) Habitus of *R. salsolae* (Mathis & Zatwarnicki), antero-oblique view. Scale bars = 0.1 mm (34), = 0.2 mm (35, 37).

Thorax: Scutum sparsely microtomentose. Prescutellar acrostichal setae lacking; 1 anepisternal seta present; scutellar disc lacking setulae. Wing: costal setulae few and sparse. Wing length: 1.08–1.32 mm. Halter knob yellow. Legs as in generic description.

Abdomen: Often extensively basally yellow, otherwise dark. Male: Male terminalia (Figs 42–45): Epandrium in posterior view (Fig. 42) as an inverted U, dorsal arch and lateral arms thin, latter becoming slightly wider ventrally, in lateral view (Fig. 43) with posterior margin nearly straight, anterior scalloped with a pointed projection at midlength between scallops; cercus in posterior view (Fig. 42) narrowly

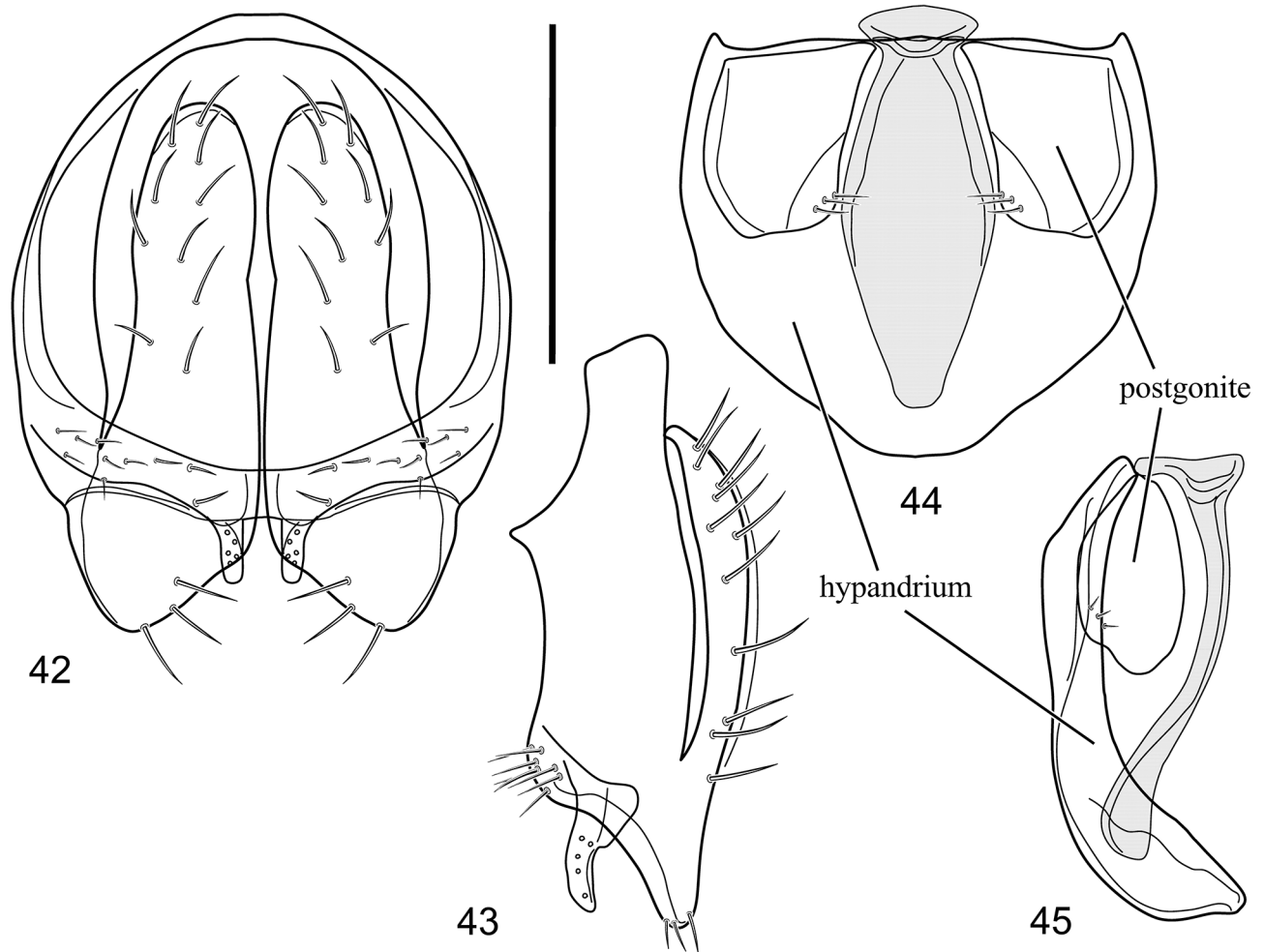
rectangular, thumb-like, dorsal margin rounded, uniformly setulose, in lateral view (Fig. 43) elongate, narrow, tapered to point dorsally; gonostylus in posterior view (Fig. 42) triangular, somewhat fused basally with ventral epandrial margin, thereafter ventrally tapered to narrowly rounded point, oriented ventrally, bearing 2–3 setulae toward apex along medial margin, in lateral view (Fig. 43) narrowly triangular, ventral apex narrowly rounded; subepandrial plate in lateral view (Fig. 43) an irregularly elliptical plate, anterior and posterior margin tapered to broadly rounded apices; in ventral view (Fig. 42) somewhat rectangular plates, bearing cluster of setulae at medioposterior corner; aedeagus



Figures 38–41. Photographs of *Risa brevisrostris* sp. nov. (38–39) and *R. longirostris* Becker (40–41). (38) Head, anterior view. (39) Same, dorso-oblique view. (40) Habitus, lateral view. (41) Head, antero-oblique view. Scale bars = 0.1 mm (38–39), = 0.2 mm (40–41).

in ventral view (Fig. 44) elliptical, elongate, in lateral view (Fig. 45) very slender, curved, slightly expanded apically; phallopodeme partially fused to base of aedeagus, in ventral view (Fig. 44) T-shaped with robust crossbar, in lateral view (Fig. 45) perpendicular to aedeagus with short, narrow keel; pregonite moderately long, gently curved in lateral view; postgonite in ventral view (Fig. 44) somewhat trapezoidal with even base, anteroventral margin rounded and bearing 3 setulae, in lateral view (Fig. 45) ovate; hypandrium in ventral view (Fig. 44) a wide plate, especially basally,

lateral margins evenly curved and tapered to broad, medial margin, in lateral view (Fig. 45) elongate, curved, pointed at anterior and posterior apices. Female: tergites 6–7 bearing a few small setulae, lacking row of long, fringe-like setulae along posterior margin (Fig. 34); tergite 8 interrupted dorsomedially; sternite 8 more or less pentagonal (length/width ca 0.7) with pointed apex directed anteriorly, evenly sclerotized, lacking protrusion; posterior margin with shallow notch medially; anterior third bearing about 22 very short, stout, black setae, these not arranged in distinct rows;



Figures 42–45. Male terminalia of *Risa brevirostris* sp. nov. (42) Epandrium, cerci, gonostylus, subepandrial plate with pregonites, ventral view. (43) Same, lateral view. (44) Internal structures (postgonite, hypandrium and aedeagus fused with phallopodeme), ventral view. (45) Same, lateral view. Scale bar = 0.1 mm.

posterior third bearing sparse setulae submarginally (Fig. 34); subanal plate lacking; ventral receptacle with paired tubular appendages; cerci short, rounded.

Type material. The holotype ♂ of *Risa (Achaetorisa) brevirostris* is labelled “ISRAEL[,] Zomet Zohar [31°08.5'N 35°21.6'E,] 9. vi. 1997 [9 Jun 1997,] A. FREIDBERG [white]/HOLOTYPE ♂ *Risa (Achaetorisa) brevirostris* Mathis & Zatwarnicki SMNH [red].” Twenty-four paratypes are as follows: ISRAEL. Zomet Zohar (31°08.5'N 35°21.6'E; on *Seidlitzia rosmarinus*), 9 Jun 1997, A. Freidberg (2♂, 1♀; SMNH); 9 Sep 1997, A. Freidberg (on *Seidlitzia rosmarinus*) (14♂, 7♀; additional specimens in alcohol; SMNH). Deir Hijleh (near Jericho; 31°49.2'N 35°30.1'E; ex *Seidlitzia rosmarinus*), 25 Sep 1997, A. Freidberg (5♂, 18♀; SMNH).

Other specimens examined. EGYPT. Sinai: Ras Umm Burká (on *Seidlitzia rosmarinus*), 1–9 May 1996, A. Freidberg (5♂♀, SMNH).

Type locality. Israel. Zomet Zohar (31°08.5'N 35°21.6'E).

Distribution. Palearctic: Israel (Dead Sea Area), Egypt (eastern Sinai).

Natural history. This species is associated with *Seidlitzia rosmarinus* Bunge ex Boiss (Amaranthaceae).

Etymology. The specific epithet, *brevirostris*, is named for this species' comparatively short mouthparts.

Risa (Achaetorisa) nettae sp. nov.

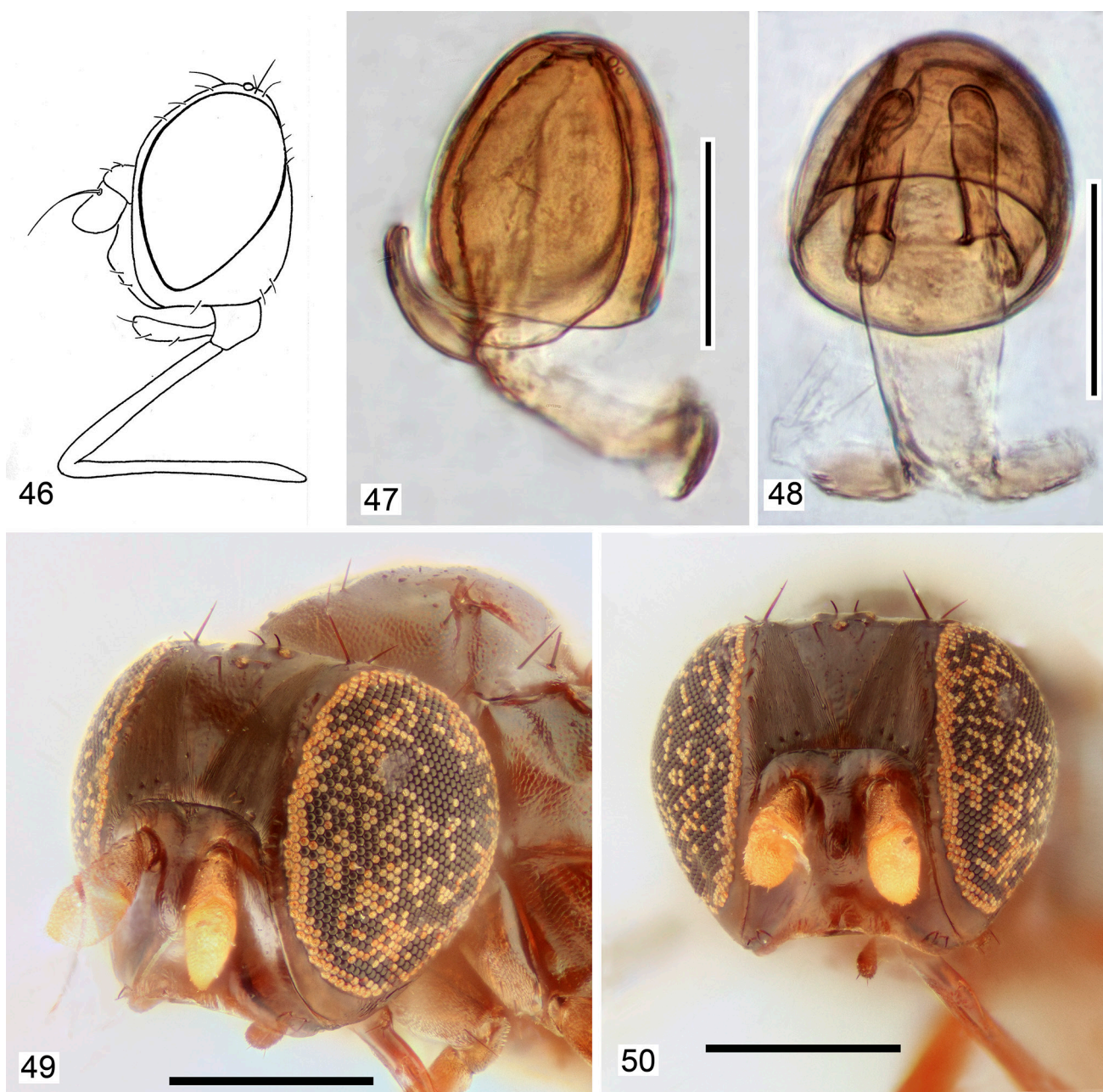
urn:lsid:zoobank.org:act:BB0DE9C8-C1AB-46F7-B475-A56099141F19

Figs 46–56

Diagnosis. This species is distinguished from congeners by the following combination of characters: Small shore flies, body length 1.14–1.50 mm.

Head: Structure: Face low, with rather prominent carina (Fig. 46); antennal ratio 0.4–11/31, 15/34, 13/31, 13/34; basal flagellomere ratio 1.33–2.00; arista branches very short; labellar ratio 2.0–2.5. **Coloration:** Antenna predominantly or entirely yellow, scape and pedicel and basal flagellomere anteroapically occasionally darker, arista yellow to brown (Figs 49, 50); palpus black to brownish; head otherwise black, without microtomentum. **Chaetotaxy:** Medial-to-lateral vertical setal ratio 1.3–2.0; fronto-orbital setae 3 (rarely 2 or 4), proclinate, small, hair-like, equal or subequal in size.

Thorax: Scutum without distinct microtomentum, appearing fatty, contrasted with strongly microtomentose

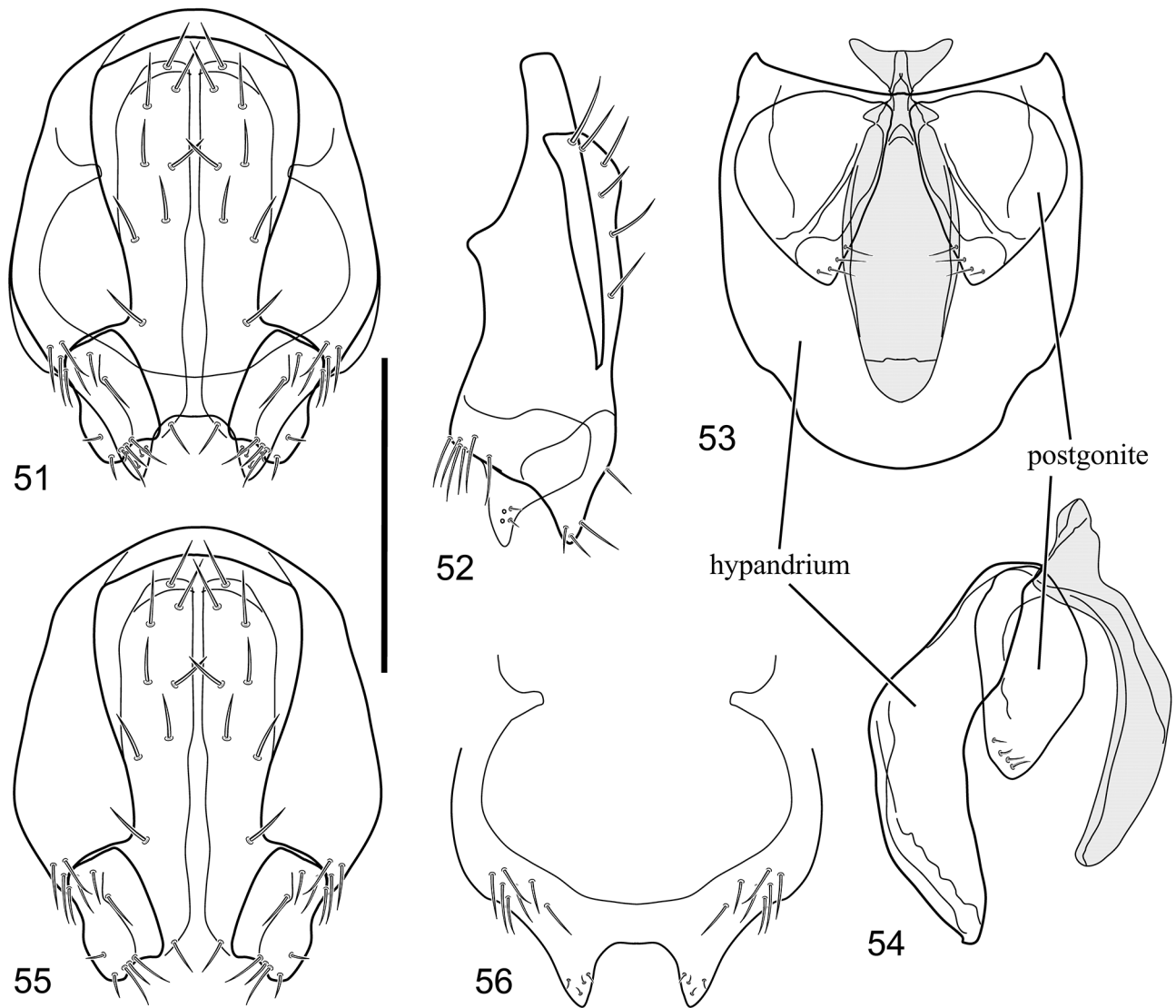


Figures 46–50. Line drawing and photographs of *Risa nettae* sp. nov. (46) Head, lateral view. (47) Ventral receptacle, lateral view (microscopic photograph). (48) Ventral receptacle, posterior view (microscopic photograph). (49) Head, anterior view. (50) Same, latero-oblique view. Scale bars = 0.05 mm (47–48), = 0.2 mm (49–50).

scutellum. Prescutellar acrostichal setae lacking; 1 anepisternal seta present, inserted slightly ventral to mid-height of posterior suture; scutellar disc lacking setulae. Wing: Costal setulae moderately numerous and dense. Wing length: 0.90–1.12 mm. Halter knob with large dark spot or at least not strongly contrasted with black coloration of body. Femora and tibiae almost entirely black or blackish; tibiae distally and sometimes narrowly basally yellowish.

Abdomen: Entirely black or blackish. Male: Male terminalia (Figs 51–56): Epandrium in posterior view (Figs 51, 55) as an inverted U, dorsal arch thin, lateral arms becoming gradually wider ventrally, in lateral view (Fig. 52) with posterior margin nearly straight, anterior scalloped with a pointed projection between scallops at midheight; cercus in posterior view (Figs 51, 55) narrowly rectangular with corners rounded except for right angle mediodorsal corner,

uniformly setulose, in lateral view (Fig. 52) elongate, very slender, wider dorsally; gonostylus in posterior view (Figs 51, 55) irregularly rectangle, somewhat fused basally with ventral epandrial margin, thereafter ventrally extended more or less straight to broadly ventral apex, apex shallowly concave, bearing numerous setulae toward apex, in lateral view (Fig. 52) triangular, broad basally, tapered to rounded point; aedeagus in ventral view (Fig. 53) elliptical, elongate, with fused phallapodeme as a fish tail, in lateral view (Fig. 54) elongate, narrow, curved, with phallapodeme as a basal, thumb-like extension; pregonite in lateral and ventral views (Figs 51, 52, 56) fused to apical arch of subepandrial plate, as triangular projections (Figs 52, 56); subepandrial plate in lateral view (Fig. 52) longer than wide, basal and apical margins rounded, apical one more so; postgonite in ventral view (Fig. 53) somewhat triangular with base



Figures 51–56. Male terminalia of *Risa nettae* sp. nov. (51) Epandrium, cerci, gonostylus, subepandrial plate with pregonites, ventral view. (52) Same, lateral view. (53) Internal structures (postgonite, hypandrium and aedeagus fused with phallapodeme), ventral view. (54) Same, lateral view. (55) Anterior section of epandrium and cerci, gonostylus (without subepandrial plate and pregonites), ventral view. (56) Subepandrial plate and pregonites, lateral view. Scale bar = 0.1 mm.

broadly rounded, apex pointed and bearing setulae, in lateral view (Fig. 54) ovate, longer than wide, base rounded, apex pointed and setulose; hypandrium in ventral view (Fig. 53) a symmetrical plate, about as wide as long, basal margin evenly and shallowly concave, posterior margin slightly narrowed and broadly rounded, in lateral view (Fig. 54) elongate, length 4 times width, shallowly angulate, pointed at anterior and posterior margins. Female: subanal plate lacking; ventral receptacle with paired tubular appendages (Figs 47, 48).

Type material. The holotype ♂ of *Risa (Achaetorisa) nettae* is labelled “ISRAEL[.] Zomet Zohar[.] [31°08.5'N 35°21.6'E,] 21. vii. 1998 [21 Jul 1998,] A. FREIDBERG/HOLOTYP ♂ *Risa (Achaetorisa) nettae* Mathis & Zatwarnicki SMNH [red.].” Thirty-nine paratypes bear the same locality, collection date, and collector as the holotype and was taken on the plant *Seidlitzia rosmarinus* (29♂, 10♀; SMNH, USNM).

Other specimens are as follows (listed alphabetically;

some specimens in poor condition or in alcohol): Israel. Deir Hijleh (near Jericho; 31°49.2'N 35°30.1'E), 19 May 1998, A. Freidberg (16♂, 28♀; SMNH, USNM). Ne'ot haKikkar (30°56'N 35°22.7'E), 4 Apr–1 May 1997, 1998, A. Freidberg (17♂♀; SMNH). Zomet Zohar (31°08.5'N 35°21.6'E), 4 Apr–14 Oct 1997, 1998, A. Freidberg, I. Yarom (90♂♀; SMNH, USNM).

Type locality. Israel. Zomet Zohar (31°08.5'N 35°21.6'E).

Distribution. Palearctic: Israel (Dead Sea Area).

Natural history. This species is associated with *Seidlitzia rosmarinus* Bunge ex Boiss (Amaranthaceae).

Etymology. The specific epithet, *nettae*, is a genitive patronym to honor our friend and colleague, Dr Netta Dorchin, for discovering and rearing numerous specimens of *Risa* from plants of the family Amaranthaceae. This discovery greatly facilitated collecting greater numbers of specimens.

Risa (Achaetorisa) salsolae
Mathis & Zatwarnicki comb. nov.

Fig. 37

Achaetorisa salsolae Mathis & Zatwarnicki, 2017: 646
[United Arab Emirates. Ajman (N; 25°25.7'N 55°30.1'E;
salt marsh); HT ♂, NMWC].

Distribution. Afrotropical: United Arab Emirates (Ajman).

Natural history. This shore-fly species is associated with *Seidlitzia rosmarinus* Bunge ex Boiss (Amaranthaceae).

Subgenus *Risa* Becker

Risa Becker, 1907:404. Type species: *Risa longirostris*
Becker, 1907:404 [monotypy].—Hennig, 1937:75
[redescription].—Papp, 1984: 178 [Palearctic catalog,
as a genus].

Diagnosis. The subgenus *Risa* is distinguished from the subgenus *Achaetorisa* by the following combination of characters: *Head:* Face usually with a conspicuous, medial carina, in lateral view carina pointed (carina inconspicuous in *R. kotrbae*).

Thorax: Prescutellar acrostichal setae usually well developed (absent in *R. kotrbae*); scutellar disc bearing a few, scattered setulae. Costal section III (between R_{2+3} and R_{4+5}) bearing approximately 70–80, densely spaced setulae.

Abdomen: Male terminalia: Cercus fused ventrally with epandrium; gonostylus either lacking or more likely fused indistinguishably with ventral margin of epandrial arm; hypandrium wider than long, almost band-like, transverse. Female terminalia: Subanal plate present; sternite 8 interrupted or thin dorsomedially, often with a sclerotized, protrusion (Fig. 33); posterior portion of sternite 8 bearing (1) numerous, mostly straight setae (*R. asiatica*), (2) numerous straight and some hooked setae (*R. flavipalpis*), or (3) numerous, long, hooked setae (*R. longirostris*, *R. longicornuta*, *R. kotrbae*); anterior margin of sternite 8 bearing numerous long setulae; cerci short and rounded; stalk of ventral receptacle lacking paired, tubular processes (Fig. 15).

Discussion. We recognize the following five species in the nominate subgenus *Risa*: *R. (R.) asiatica* Ozerov, *R. (R.) flavipalpis* Ozerov, *R. (R.) kotrbae* sp. nov., *R. (R.) longicornuta* Papp, *R. (R.) longirostris* Becker (*R. mongolica* Papp is possibly conspecific).

Risa (Risa) kotrbae sp. nov.

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Figs 57–64

Diagnosis. This species is distinguished from congeners by the following combination of characters: Small shore flies, body length 1.40–1.56 mm.

Head: Structure: Face high, with shallow carina (Figs 58, 60); antennal ratio $\frac{1}{5}$; basal flagellomere ratio about 2; arisal hairs very short; labellar ratio about 1–1.2. *Coloration:* Antenna as for genus; palpus black; head otherwise black; ventral portion of frons, including apex of ocellar triangle, parafacial and lateral margin of face including antennal groove conspicuously whitish to silvery microtomentose

(Figs 57, 58, 60); most of ocellar triangle bare, shiny. *Chaetotaxy:* Medial-to-lateral vertical setal ratio 2–3; fronto-orbital setae 3 (rarely 2 or 4), proclinate, small, hair-like, equal or subequal in size.

Thorax: Scutum rather densely microtomentose. Prescutellar acrostichal setae lacking; 1 anepisternal seta present; scutellar disc bearing sparse and scattered setulae (Fig. 60). Wing: costal setulae few and sparse. Wing length: 1.16–1.40 mm. Halter yellow. Legs as in generic description.

Abdomen: Entirely dark. Male: Male terminalia (Figs 61–64): Epandrium in posterior view (Fig. 61) rectangular with dorsal margin produced medially, lateral margins sinuous, ventral margin slanted medioventrally, bearing 2 narrow pregonital projections medially, these tapered and with apices recurved, in lateral view (Fig. 62) epandrium much longer than wide, with angulate projection at dorsal third, ventral postgonal projection with posterior recurve thumb-like, length of recurve about half total height of surstylar projection, epandrium bearing 6–8 setulae in cluster toward base of ventral projection; cercus in posterior view (Fig. 61) rectangular, dorsal margin slightly produced mediodorsally, basal margin fused with ventromedial margin of epandrium, bearing setulae along length, in lateral view (Fig. 62) distinctly narrowed dorsally, and curved anteriorly, thereafter ventrally slightly expanded, narrowly spatulate before ventral fusion with epandrium; aedeagus in ventral view (Fig. 63) elliptical, elongate, phallapodeme fused to base, in lateral view (Fig. 64) aedeagus narrowly digitiform, apical half slightly wider than base, rod-like, fused phallapodeme irregularly bifurcate at base, with longer process, narrow, digitiform, other process wider at base, tapered to point apically; internally with subepandrial plate at medial base of epandrium, in ventral view (Fig. 61) sclerite wider than long, base shallowly projected medially, rest of arch deeply bifurcate, each lateral projection bearing a postgonite, latter shallowly digitiform, bearing 2–3 apical setulae, in lateral view (Fig. 64) with irregular quadrate base with rounded corner toward base, thereafter apically as trifurcate with postgonite as medial projection; hypandrium in ventral view (Fig. 63) pentagonal with base truncate and sharply angulate at basolateral corners, posterior half evenly angled medially, medial margin broadly rounded, in lateral view (Fig. 64) slipper-like, tapered and shallowly curved posteriorly to pointed apex. Female: Tergites 6–7 bearing row of fringe-like, long setulae along posterior margin; tergite 8 bare, in 3 sections, interrupted dorsolaterally; sternite 8 transversely oval (length/width ca. 0.5); middle of sternite 8 with a shallow, transverse, truncate protrusion separating setulose anterior $\frac{4}{5}$ of sternite from bare posterior margin; anterior portion bearing about 28 stout, black setae in more than 2 irregular rows toward anterior margin; setae relatively long with pointed apices curved anteriorly; posteriorly anterior portion bearing fringe of long, apically hooked setulae; subanal plate present, triangular; ventral receptacle lacking paired tubular appendages; cerci short, rounded.

Type material. The holotype ♂ of *Risa kotrbae* is labelled “ISRAEL[,] Zomet Zohar [31°08.5'N 35°21.6'E], 9. vi. 1997 [9 Jun 1997,] A. FREIDBERG [white]/HOLOTYPE ♂ *Risa kotrbae* Mathis & Zatwarnicki SMNH [red].” Thirty-nine paratypes (SMNH, USNM) bear the same locality label as the holotype (additional specimens in alcohol; SMNH). Other paratypes are as follows: ISRAEL. Kalya (31°45'N



Figures 57–60. Photographs of *Risa kotrbae* sp. nov. (57) Head, anterior view. (58) Head and thorax, lateral view. (59) Same, dorsal view. (60) Same, dorsolatero-oblique view. Scale bars = 0.2 mm (57), = 0.5 mm (58–60).

35°28'E; ex *Suaeda palaestina* Eig & Zohary), 9 May–28 Sep 1995, 1996, A. Freidberg, B. Merz, I. Yarom (22♂, 15♀; SMNH); Nahal Qidron (31°47.1'N 34°38.1'E; Rt. 90), 7 Jun–10 Jul 1996, A. Freidberg, B. Merz (33♂, 22♀; SMNH; additional specimens in alcohol; SMNH); Zomet Mezada (31°18.8'N 35°23'E; swept from *Suaeda fruticosa* Forsskål, occasionally from *S. palaestina*), 10 Jul 1996, A. Freidberg (28♂, 5♀; SMNH).

Type locality. Israel. Zomet Zohar (31°08.5'N 35°21.6'E).

Distribution. Palearctic: Israel.

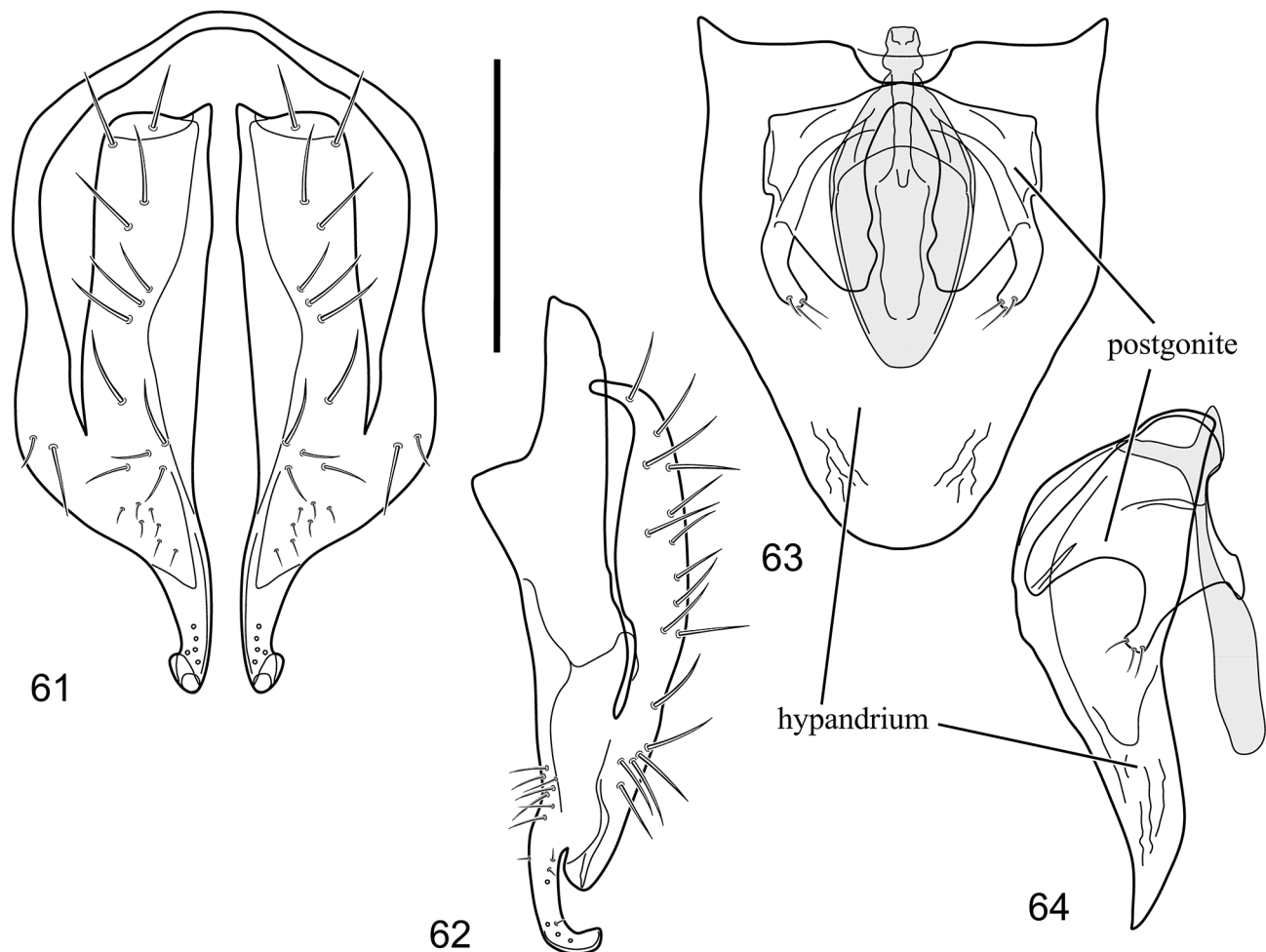
Natural history. This species is associated with *Suaeda fruticosa* Forsskål and *Suaeda palaestina* (Amaranthaceae).

Etymology. The specific epithet, *kotrbae*, is a Latin genitive patronym to honor our friend and colleague, Dr Marion Kotrba, for her numerous contributions to the systematics of Diptera, especially female reproductive systems, including those for species of *Risa*.

ACKNOWLEDGEMENTS. We gratefully acknowledge the assistance and cooperation of many organizations and individuals who contributed to the field work and production of this paper. To the curators and collection managers noted previously who loaned specimens, we express our sincere thanks. We also thank Martin J. Ebejer (NMWC) for re-examining the type series of *R. salsolae*. Young T. Sohn† rendered the habitus line drawings and is thanked. For reviewing a draft of this paper, we thank Martin J. Ebejer and Marion Kotrba.

References

- Becker, Th. 1907. Die Ergebnisse meiner dipterologischen Frühjahrsreise nach Algier und Tunis. 1906. *Zeitschrift für systematische Hymenoptero-logie und Dipterologie* 7(5): 369–407.
<https://doi.org/10.5962/bhl.title.9280>
- Brake, I. 2000. Phylogenetic systematics of the Milichiidae (Diptera, Schizophora). *Entomologica scandinavica, Supplement* 57, 120 pp.



Figures 61–64. Male terminalia of *Risa kotrbae* sp. nov. (61). Epandrium, cerci, gonostylus, ventral view. (62) Same, lateral view. (63) Internal structures (postgonite, hypandrium and aedeagus fused with phallapodeme), ventral view. (64) Same, lateral view. Scale bar = 0.1 mm.

Chandler, P. J. 1987. The families Diastatidae and Campichoetidae (Diptera, Drosophilidae) with a revision of Palaearctic and Nepalese species of *Diastata* Meigen. *Entomologica Scandinavica* 18: 1–50.

<https://doi.org/10.1163/187631287X00016>

Clausen, P. J., and E. F. Cook. 1971. A revision of the Nearctic species of the tribe Parydrini (Diptera: Ephyridae). *Memoirs of the American Entomological Society* 27: 1–150.

Cresson, E. T. 1925. Studies in the dipterous family Ephyridae, excluding North and South American faunas. *Transactions of the American Entomological Society* 51: 227–258.

Cumming, J. M., and D. M. Wood. 2017. [Chapter] 3. Adult morphology and terminology. In *Manual of Afrotropical Diptera. Volume 1. Introductory Chapters and Keys to Diptera Families*, ed. A. H. Kirk-Spriggs and B. J. Sinclair, pp. 89–133. Pretoria: Suricata 4, South African National Biodiversity Institute.

Enderlein, G. 1934. Heringiinae, eine neue miniierende Chloropiden Unterfamilie. *Zoologischer Anzeiger* 105: 191–195.

Enderlein, G. 1936. 22. Ordnung: Zweiflügler, Diptera. Abt. 16, In *Die Tierwelt Mitteleuropas*, ed. P. Brohmer, P. Ehrmann, and G. Ulmer, vol. 6(2), 259 pp. Leipzig: Insekten, Teil III.

Griffiths, G. C. D. 1972. *The Phylogenetic Classification of Diptera Cyclorrhapha, with Special References to the Structure of the Male Postabdomen*, Series entomologica 8. The Hague: W. Junk, N. V., 340 pp.

https://doi.org/10.1007/978-94-015-7243-9_3

Griffiths, G. C. D. 1990. Book Review. *Manual of Nearctic Diptera. Volume 3. Questiones Entomologicae*, 26: 117–130.

Grimaldi, D. A. 1990. A phylogenetic, revised classification of genera in the Drosophilidae (Diptera). *Bulletin of the American Museum of Natural History* 197: 139 pp.

Hennig, W. 1937. 60a. Milichiidae et Carnidae. In *Die Fliegen der palaearktischen Region*, ed. E. Lindner, 6(1): 1–91.

Hennig, W. 1965. Die Acalyptatae des Baltischen Bernsteins und ihre Bedeutung für die Erforschung der phylogenetischen Entwicklung dieser Dipteregruppe. *Stuttgarter Beiträge zur Naturkunde* 145: 1–215.

Hennig, W. 1973. Diptera (Zweiflüger). In *Handbuch der Zoologie, Eine Naturgeschichte der Stämme des Tierreiches. IV. Band: Arthropoda—2. Hälfte: Insecta. 2. Teil: Spezielles*, ed. J. G. Helmcke, D. Starck, and H. Vermuth (a cura di). Berlin: De Gruyter.

Kotrba, M., and W. N. Mathis. 2009. The internal female reproductive tract of the enigmatic genus *Risa* (Diptera: Schizophora: Ephydroidea) and its phylogenetic implications. *Proceedings of the Entomological Society of Washington* 111(3): 627–640.

<https://doi.org/10.4289/0013-8797-111.3.627>

Krivosheina, M. G., and A. L. Ozerov. 2019. To the fauna of *Risa* Becker, 1907, (Diptera: Ephyridae) of Central Asia. *Journal of Russian Entomology* 28(2): 192–194.

<https://doi.org/10.15298/rusentj.28.2.14>

Mathis, W. N. 1986. Studies of Psilopinae (Diptera: Ephyridae), I: A Revision of the Shore Fly Genus *Placopsidella* Kertész. *Smithsonian Contributions to Zoology* 430, iv+30 pp.

<https://doi.org/10.5479/si.00810282.430>

- Mathis, W. N., and T. Zatwarnicki. 1990a. A Revision of the Western Palearctic Species of *Athyroglossa* (Diptera: Ephydridae). *Transactions of the American Entomological Society* 116(1): 103–133.
- Mathis, W. N., and T. Zatwarnicki. 1990b. Taxonomic notes on Ephydridae (Diptera). *Proceedings of the Biological Society of Washington* 103(4): 891–906.
- Mathis, W. N., and T. Zatwarnicki. 1995. A World Catalog of the Shore Flies (Diptera: Ephydridae). *Memoirs on Entomology, International* 4: vi+423 pp.
- Mathis, W. N., and T. Zatwarnicki. 1998. 3.49. Family Ephydridae. In *Contributions to a Manual of Palearctic Diptera (with Special Reference to Flies of Economic Importance)*, ed. L. Papp and B. Darvas, pp. 537–570. Volume 3. High Brachycera. Budapest, Hungary: Science Herald, 880 pp.
- Mathis, W. N., T. Zatwarnicki, J.-H. Stuke, and J. C. Deeming. 2017. Order Diptera, family Ephydridae. A conspectus on the shore flies from the United Arab Emirates. Pp. 636–761, 160 figs, 40 pls. In *Arthropod Fauna of the United Arab Emirates*, ed. A. van Harten, Abu Dhabi, United Arab Emirates: Department of the President's Affairs, volume 6, 775 pp.
- McAlpine, D. K. 2002. Some examples of reduced segmentation of the arista in Diptera-Cyclorrhapha, and some phylogenetic implications. *Studia dipterologica* 9(1): 3–19.
- McAlpine, D. K. 2011. Observations on antennal morphology in Diptera, with particular reference to the articular surfaces between segments 2 and 3 in the Cyclorrhapha. *Records of the Australian Museum* 63(2): 113–166.
<https://doi.org/10.3853/j.0067-1975.63.2011.1585>
- McAlpine, J. F. 1989. 116. Phylogeny and classification of the Muscomorpha. In *Manual of Nearctic Diptera*, ed. J. F. McAlpine, volume 3: 1397–1518. Ottawa: Research Branch Agriculture Canada, Monograph no. 32, pages vi+1333–1581.
- Melander, A. L. 1913. A synopsis of the dipterous groups Agromyzinae, Milichiinae, Ochthiphilinae and Geomyzinae. *Journal of the New York Entomological Society* 21(3): 219–273.
- Ozerov, A. L. 1984. New species of the genus *Risa* (Diptera, Risidae) from Middle Asia. *Zoologicheskii Zhurnal* 6: 945–948 [in Russian with an English title and abstract].
- Ozerov, A. L. 1992. To the knowledge of Risidae of the fauna of the USSR. *Zoologicheskii Zhurnal* 14: 151–153 [in Russian with an English title and abstract].
- Papp, L. 1977. Notes on some Becker's types (Diptera, Carnidae and Risidae fam. n.). *Annales Historico-Naturales Musei Nationalis Hungarici* 69: 185–189.
- Papp, L. 1980. New taxa of the acalyprate flies (Diptera: Tunisimyidiidae fam. n., Risidae, Ephydridae: Nannodastiinae subfam. n.). *Acta Zoologica Academiae Scientiarum Hungaricae* 26: 415–431.
- Papp, L. 1984. Family Risidae. In *Catalogue of Palearctic Diptera*, ed. A. Soós and L. Papp, pp 177–178. Budapest: Akadémiai Kiadó, vol. 10.
- Steyskal, G. C. 1968. Notes and descriptions of Egyptian acalyprate Diptera (Ephydridae, Milichiidae, Otitidae). *Bulletin de la Société Entomologique d'Égypte* 50: 109–125.
- Stuckenberg, B. R. 1999. Antennal evolution in the Brachycera (Diptera), with a reassessment of terminology relating to the flagellum. *Studia Dipterologica* 6: 33–48.
- Wiegmann, B. M., M. D. Trautwein, I. S. Winkler, N. B. Barr, J.-W. Kim, C. Lambkin, M. A. Bertone, B. K. Cassel, K. M. Bayless, A. M. Heimberg, B. M. Wheeler, K. J. Peterson, T. Pape, B. J. Sinclair, J. H. Skevington, V. Blagoderov, J. Caravas, S. N. Kuttu, U. Schmidt-Ott, G. E. Kampmeier, F. C. Thompson, D. A. Grimaldi, A. T. Beckenbach, G. W. Courtney, M. Friedrich, R. Meier, and D. K. Yeates. 2011. Episodic radiations in the fly tree of life. *Proceedings of the National Academy of Sciences United States* 108: 5690–5695.
<https://doi.org/10.1073/pnas.1012675108>
- Winkler, I. S., A. H. Kirk-Spriggs, K. M. Bayless, J. Soghigian, R. Meier, T. Pape, et al. 2022. Phylogenetic resolution of the fly superfamily Ephydroidea—molecular systematics of the enigmatic and diverse relatives of Drosophilidae. *PLoS ONE* 17(10): e0274292.
<https://doi.org/10.1371/journal.pone.0274292>
- Zatwarnicki, T. 1992. A new classification of Ephydridae based on phylogenetic reconstruction (Diptera: Cyclorrhapha). *Genus* 3(2): 65–119.
- Zatwarnicki, T. 1996. A new reconstruction of the origin of eremoneuran hypopygium and its implications for classification (Insecta: Diptera). *Genus* 7(1): 103–175.
- Zatwarnicki, T. 2018. Solving the puzzle of taxonomic position of the petroleum fly by resurrection of *Diasemocera* Bezzi from *Psilopa* Fallén (Diptera: Ephydridae) with proposed specific and generic synonymies. *Annales Zoologici* 68(3): 527–552.
<https://doi.org/10.3161/00034541ANZ2018.68.3.012>
- Zatwarnicki, T., and I. Ryczko. 2014. Phylogeny of Hyadinini (Diptera: Ephydridae) with an emphasis on structures of the proboscis. *Annales Zoologici* (Warsaw) 64(3): 495–515.
<https://doi.org/10.3161/000345414X684821>