

A NEW SPECIES OF *BARYSCAPUS* FÖRSTER FROM SPAIN (HYMENOPTERA: CHALCIDOIDEA: EULOPHIDAE), ASSOCIATED WITH GALLS ON *ARTEMISIA HERBA-ALBA*

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Abstract: A new species of *Baryscapus* Förster is described. *Baryscapus brevicornis* sp.n. was reared from galls of *Ptiloedaspis tavaresiana* (Diptera: Tephritidae) on *Artemisia herba-alba*. Details of other parasitoids associated with these galls are given.

Key words: Hymenoptera, Chalcidoidea, Eulophidae, Tetrastichinae, *Baryscapus*, new species.

Una nueva especie de *Baryscapus* Förster de España (Hymenoptera: Chalcidoidea: Eulophidae), asociada con agallas en *Artemisia herba-alba*

Resumen: Se describe una nueva especie de *Baryscapus* Förster. *Baryscapus brevicornis* sp.n. se obtuvo emergiendo de agallas de *Ptiloedaspis tavaresiana* (Diptera: Tephritidae) en *Artemisia herba-alba*. Se detallan otros parasitoides asociados con dichas agallas.

Palabras clave: Hymenoptera, Chalcidoidea, Eulophidae, Tetrastichinae, *Baryscapus*, nueva especie.

Taxonomy/Taxonomía: *Baryscapus brevicornis* sp.n.

Introduction

The genus *Baryscapus* Förster, 1856, in the subfamily Tetrastichinae of Eulophidae, is very speciose and biologically diverse, with a cosmopolitan distribution. Most abundant in the Holarctic region, it is the third largest genus by number of species in the Tetrastichinae, currently containing 116 recognized species (Noyes, 2013). It is characterized mainly by the body being black, or usually with metallic reflections, without pale markings (but tegulae sometimes yellow), submarginal vein with 2 or more dorsal setae, gaster with cercal setae short and subequal in length, malar sulcus distinctly curved, and propodeal spiracles wholly exposed, not covered by a flap of the callus. The species of *Baryscapus* attack a wide variety of insect hosts (Lepidoptera, Hymenoptera, Coleoptera, Diptera, rarely Neuroptera and Hemiptera Coccoidea), as primary endoparasitoids or hyperparasitoids, solitary or commonly gregarious in bigger hosts, and either idiobionts or briefly koinobionts (Askew & Shaw, 2005). The European species have been revised by Graham (1991), and classified in two species groups, *daira* and *evonymellae*. Since Graham's revision, a number of species have been described, several in the *daira* group (Doğanlar, 1993; Kostjukov & Tuzlikova, 2002; Askew & Shaw, 2005; Viggiani *et al.*, 2007). There are also several non-European species which are currently placed in *Tetrastichus* Haliday, 1844 but belong to either species group of *Baryscapus*.

Materials and methods

Specimens of a new species of *Baryscapus* in the *daira* group were found in Lleida province, Spain, during a survey of the Chalcidoidea of the region. They emerged from *Ptiloedaspis tavaresiana* Bezzi, 1920 (Diptera: Tephritidae) galls on *Artemisia herba-alba* Asso. Further samples of these galls were

collected at several locations and at different seasons of the year. Plant samples were stored indoors in polythene bags, controlled for condensation and fungal growth, and checked periodically for chalcid emergences. Other gall samples were dissected for further biological observations.

The specimens of Chalcidoidea that emerged from the galls were either killed with ethyl acetate, or placed directly in ethanol. Specimens in ethanol were dried using HMDS, and mounted on cards. Some parts of antennae and wings were placed on microscope slides for detailed observation, using PVA as the mounting medium. Observations of card mounted specimens were made using a stereomicroscope with a maximum magnification of 90x, and a 144-LED ring as a light source. Measurements were taken mostly at maximum magnification, with an eye-piece micrometer with a scale of 10 mm divided by 100 units. Measurements of the females were taken from the holotype and six paratypes, the range of values for each measurement was evaluated, and any extreme value considered erroneous was either checked for accuracy or discarded. Photographs of whole specimens were taken with a compact digital camera placed over a trinocular stereomicroscope. Details of antennae and wings were similarly taken from slides with a trinocular optical microscope. Multiple images of each photograph were combined using CombineZ5 software (Alan Hadley, micropics.org.uk). Scanning electron microphotographs (SEM) were taken of HMDS dried and gold coated dissected specimen parts using DSM940A Zeiss equipment (high vacuum technique), at the “Servei de Microscopia Electrònica de la Universitat de Lleida” (UdL).

Several species of *Baryscapus* in the *daira* group were examined for comparison while preparing the description. These are mostly part of the author's collection, including *B. daira* (Walker, 1839), *B. crassicornis* (Erdős, 1954), *B.*

diaphantus (Walker, 1839), *B. pallidae* Graham, 1991 and *B. papaveris* Graham, 1991, all these species reared from their hosts and identified by the author. Other species were compared on the basis of descriptions and illustrations. Terminology in the description follows Hymenoptera Anatomy Consortium (2013), except for *dorsellum* (sensu Graham, 1991), used instead of its synonym *metascutellum*. The following abbreviations are used for morphological terms in the text: F1-F4, flagellar segments 1-4; C1-C3, club segments 1-3; POL, posterior ocellar length; OOL, ocular ocellar length; OD, ocellar diameter. Measurements of the mesosoma were taken as follows: length in dorsal or lateral view from pronotal collar to apex of propodeum; width in dorsal view between mesoscutum lateral lobes, excluding tegulae; high in lateral view from lower part of mesopleuron adjacent to mid coxa to dorsal surface of scutellum.

Results and discussion

Baryscapus brevicornis sp.n.

DIAGNOSIS. Vertex atypical, with ocellar triangle marked off by pale yellowish sutures, the sutures behind the posterior ocelli broken medially, and with another similar pale suture between ocellar triangle and each eye. Female antennae with flagellar segments very transverse, F1-F3 0.5-0.78x as long as broad. Mesosoma elongate, 1.7-1.85x as long as broad, mesoscutum with median line absent. Propodeum long, with spiracles separated from metanotum by 1-1.2x their diameter. Gaster long ovate, acute but not acuminate, with ovipositor sheaths not projecting.

DESCRIPTION.

Female: Body length 1.4-1.45 (1.3-1.65) mm. Body (fig. 1a, 1c) black, usually with dark bronze metallic reflections, sometimes with dark bluish reflections. Sutures of several sclerites testaceous, as, usually, the sutures in the ocellar triangle, sometimes also those of prepectus and scapulae. Tegulae black like the mesosoma. Antennae with scape and pedicel blackish brown, flagellum brown to dark brown. Legs with coxae and femora coloured as body, tibiae and tarsi dark brown, with two basal tarsomeres paler brown.

Head in dorsal view (fig. 1d) 1.07-1.15x as broad as mesoscutum, and 1.95-2x as broad as long, temples 0.38-0.43x as long as eye length. POL 1.7-2x OOL, OOL 1.8-2.15x OD. Vertex with ocellar triangle marked off by pale yellowish sutures except for a narrow portion posteriorly, pale straight sutures also present between ocellar triangle and each eye. Eyes 1.27-1.33x as long as broad, separated by 2.1-2.33x their length, eyes with short pilosity. Head in frontal view (fig. 2a) 1.06-1.16x as broad as high, frons with fine alutaceous sculpture, to almost smooth on face, clypeus (fig. 2e) bilobed. Occipital surface of head in posterior view (fig. 2b) with very shallow alutaceous sculpture. Malar space 0.7-0.76x height of eye, malar sulcus in strictly lateral view distinctly curved. Mouth opening 1.1-1.23x as broad as malar space.

Antennae (fig. 1e) inserted below level of inferior margin of eyes. Scape 0.71-0.78x height of eye, not reaching anterior ocellus, 3.75-4.25x as long as broad, with few setae on anterior margin. Pedicel plus flagellum 0.7-0.74x as long as breadth of mesoscutum, pedicel 1.75-2x as long as broad and 1.9-2.5x as long as F1. Annular segment 1, discoid. Funi-

cle with 3 very transverse segments, subequal in length, proximally slightly stouter than pedicel, 1.15-1.35x as broad as pedicel, distally slightly thickening, F3 1.15-1.25x as broad as F1, F1-F3 0.62-0.78x, 0.5-0.63x and 0.58-0.74x as long as broad respectively. Clava 3-segmented, sutures shallow, clava 1.6-1.8x as long as broad, 1.1-1.3x as broad as F3 and 1.45-1.65x as long as F2+F3, as long as the whole funicle, clava slightly pointed at apex, apical spine short and indistinct, apical spine 0.25x as long as C3, apical setae 3x as long as apical spine. Flagellum with short, semierect pilosity, sensillae in 1 row on each segment.

Mesosoma elongate, 1.7-1.85x as long as broad, slightly flattened, 1.15-1.2x as broad as high and 2-2.12x as long as high, propodeal slope at 25-30°. Pronotum 0.38-0.45x as long as mesoscutum, with scattered adpressed short setae over its surface and a row of longer setae on posterior margin. Mid-lobe of mesoscutum (fig. 2c) as long as broad, with median line absent, or only indicated as a trace due to a change in sculpture orientation, mesoscutum with reticulate sculpture moderately strong, superficial, not very shiny, with areoles about thrice as long as broad. Adnotaular setae in a row of 3-4 pale setae, plus 1(2) setae sometimes in a partial second row. Scutellum (fig. 2d) 1.15-1.2x as broad as long, 0.58-0.65x as long as mesoscutum, weakly convex in both axes, sculpture slightly finer than that of mesoscutum; scutellar submedian lines shallow, nearer to sublateral lines than to each other, slightly diverging posteriorly, enclosing a space 1.9-2.1x as long as broad; scutellum with two pairs of setae, the anterior pair slightly beyond the middle, placed slightly nearer to submedian lines than to sublateral lines, their length 0.9-1.05x distance between submedian lines. Dorsellum 2.75-3x as broad as long, sculptured. Propodeum (fig. 2f) long, medially with a narrow and rather deep emargination, medially 1.5-1.65x as long as dorsellum and 0.4-0.45x as long as scutellum, at median panels 2.1-2.25x as long as dorsellum and 0.5-0.65x as long as scutellum, propodeum width 2.5-2.7x as length at sides, with reticulation moderately fine, median carina distinct and low, paraspiracular carinae absent. Propodeal spiracles subcircular, separated from hind margin of metanotum by 1-1.2x a diameter, callus with 3 (2-5) setae in an irregular row. Hind coxae without a subdorsal carina on their outer surface. Legs of moderate length and thickness, hind coxa shiny, 1.8-2.1x as long as broad, hind femora 3.45-3.75x as long as broad, mesotibia with spur as long as basitarsus, fourth tarsomere as long as basitarsus.

Forewing (fig. 1g) 2.03-2.07x as long as broad, venation brownish, with decolorized breaks on parastigma and base of stigmal vein. Submarginal vein with 3 (2-4) dorsal setae. Costal cell 8.8-10x as long as broad, 1.05-1.15x as long as marginal vein, its lower surface with a complete row of setae. Marginal vein moderately thick, 2.1-2.33x as long as stigmal vein, with 8-10 setae on its front edge. Stigmal vein at an angle of 45° with respect to costal wing margin, narrow at base and expanding slightly distally, stigma elongate with long uncus. Postmarginal vein absent or rudimentary. Speculum small to moderate, reaching but not extending below marginal vein, closed below, wing surface with moderately dense pilosity beyond speculum, more densely pilose distally. Basal cell bare, open below. Forewing marginal cilia short, 0.17-0.21x as long as stigmal vein. Hindwing subobtusate at apex, with marginal cilia 0.25-0.32x as long as width of hindwing.

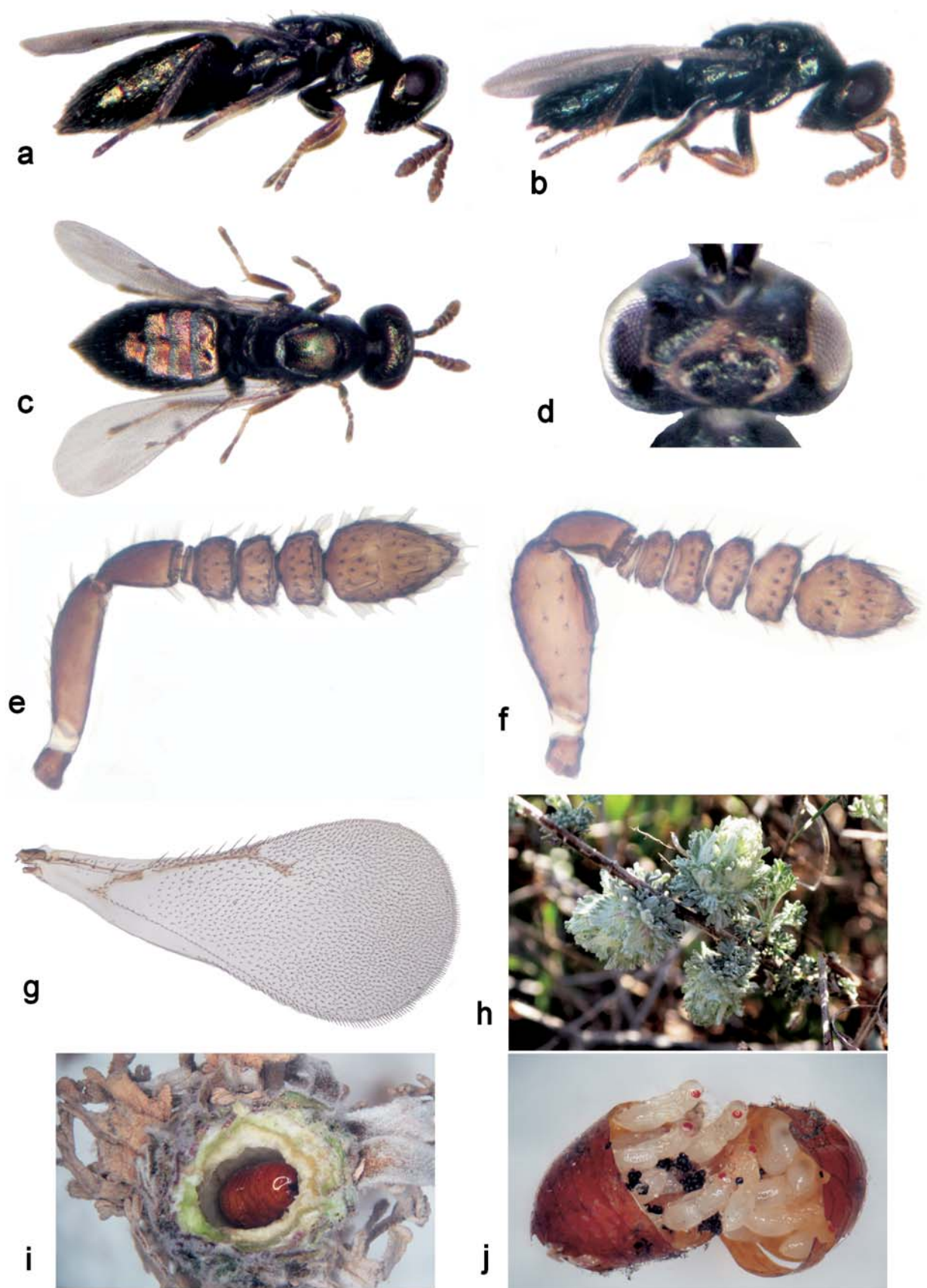


Fig. 1. *Baryscapus brevicornis* sp. n. **a)** female, lateral view; **b)** male, lateral view; **c)** female, dorsal view; **d)** female head, dorsal view; **e)** female antenna; **f)** male antenna; **g)** female forewing; **h)** *Ptiloedaspis tavaresiana* galls on *Artemisia herba-alba*; **i)** dissected gall containing *P. tavaresiana* pupa; **j)** dissected *P. tavaresiana* pupa containing gregarious *B. brevicornis* pupa. **Fig. 1.** *Baryscapus brevicornis* sp. n. **a)** hembra, aspecto lateral; **b)** macho, aspecto lateral; **c)** hembra, aspecto dorsal; **d)** cabeza de la hembra, aspecto dorsal; **e)** antena de la hembra; **f)** antena del macho; **g)** ala anterior de la hembra; **h)** agallas de *Ptiloedaspis tavaresiana* en *Artemisia herba-alba*; **i)** agalla abierta conteniendo pupa de *P. tavaresiana*; **j)** pupa de *P. tavaresiana* abierta conteniendo pupas gregarias de *B. brevicornis*.

Gaster long ovate, 1.75-2.15x as long as broad, 0.86-0.97x as long as head plus mesosoma, 1.07-1.24x as long and 1-1.15x as broad as mesosoma, acute at apex. Last tergite 1.6-1.78x as broad as long. Cercal setae subequal in length, pale, nearly straight. Ovipositor sheaths not projecting. Hypopygium tip reaching 0.55-0.65x length of gaster. Hypopygium (fig. 2g) with lateral lobes broad, median lobe less broad, shorter, and narrowing at apex, and with 2 pairs of setae at apex.

Male: Similar to female, differing in antennae and gaster structure. Body (fig. 1b) length 1.25 mm. Antennae (fig. 1f) with scape somewhat broadened, 2.25-2.5x as long as broad, ventral plaque 0.38x as long as scape, placed in the upper half. Pedicel plus flagellum 0.65x as long as breadth of mesoscutum. Funicle with 4 very transverse flagellar segments, with short suberect setae, without whorls of long dark setae, F1-F4 0.46x, 0.48x, 0.50x and 0.53x as long as broad respectively, funicle with F2-F4 and clava of about equal breadth. Clava 1.42x as long as broad, 1.35x as long as F3+F4. Gaster 1.47x as long as broad, as long as mesosoma. Male genitalia (fig. 2h) about 4x as long as broad, digitus with one strong spine directed obliquely.

HOLOTYPE. SPAIN, Lleida: Torres de Segre, Tossal de Carrasumada, UTM 31T BF99, 210m, 1 ♀, reared from *Ptiloedaspis tavaresiana* galls on *Artemisia herba-alba*, collected 28.ii.2012, emerged 13.v.2012 (*leg.* A. Ribes).

ALLOTYPE. SPAIN, Lleida: 1 ♂, data as for the holotype.

PARATYPES. 85 ♀♀, 19 ♂♂, all specimens reared from *Ptiloedaspis tavaresiana* galls on *Artemisia herba-alba* (*leg.* A. Ribes). SPAIN, Lleida: Torres de Segre, 19 ♀♀, 4 ♂♂, same data as holotype; Utxesa, UTM 31T BF99, 140m, 15 ♀♀, 5 ♂♂, galls collected 12.iii.2008, emerged 30.iv-4.v.2008; Aitona, UTM 31T BF89, 21 ♀♀, 6 ♂♂, galls collected 19.xii.2007, emerged 2-8.v.2008; Montoliu, UTM 31T CG00, 8 ♀♀, 1 ♂, galls collected 19.i.2008, emerged 11.v.2008; La Granja d'Escarp, UTM 31T BF78, 90m, 10 ♀♀, 1 ♂, galls collected 20.iii.2012, emerged 8.iv-13.v.2012; Seros, UTM 31T BF89, 165m, 12 ♀♀, 2 ♂♂, galls collected 3.iii.2008, emerged 9-15.v.2008.

The holotype, allotype and some paratypes are deposited in the Museo Nacional de Ciencias Naturales, Madrid, and the remaining paratypes in the author's collection.

ADDITIONAL MATERIAL. 672 ♀♀, 54 ♂♂, all specimens reared from *Ptiloedaspis tavaresiana* galls on *Artemisia herba-alba* (*leg.* A. Ribes). SPAIN, Lleida: Torres de Segre, 71 ♀♀, 5 ♂♂, same data as holotype; Utxesa, UTM 31T BF99, 140m, 70 ♀♀, galls collected 12.iii.2008, emerged 30.iv-4.v.2008; Aitona, UTM 31T BF89, 98 ♀♀, 12 ♂♂, galls collected 19.xii.2007, emerged 2-8.v.2008; Montoliu, UTM 31T CG00, 56 ♀♀, 4 ♂♂, galls collected 13.xii.2006, emerged i-iii.2007 (forced); Montoliu, UTM 31T CG00, 13 ♀♀, 2 ♂♂, galls collected 19.i.2008, emerged 11.v.2008; Montoliu, UTM 31T CG00, 20 ♀♀, 2 ♂♂, galls collected 18.iii.2011, emerged 29.iv.2011; Algerri, UTM 31T CG03, 350m, 27 ♀♀, 12 ♂♂, galls collected 19.i.2007, emerged ii.2007 (forced); Sarroca, UTM 31T BF99, 160m, 52 ♀♀, 4 ♂♂, galls collected 8.ii.2007, emerged iii-iv.2007 (forced); La Granja d'Escarp, UTM 31T BF78, 90m, 22 ♀♀, 2 ♂♂, galls collected 31.xii.2007, emerged 11-14.v.2008; La Granja d'Escarp, UTM 31T BF78, 90m, 139 ♀♀, 5 ♂♂, galls collected

20.iii.2012, emerged 8.iv-13.v.2012; Seros, UTM 31T BF89, 165m, 82 ♀♀, 5 ♂♂, galls collected 3.iii.2008, emerged 9-15.v.2008; Alcanó, UTM 31T CF09, 210m, 22 ♀♀, 1 ♂, galls collected 29.ii.2012, emerged 13.v.2012.

ETYMOLOGY. Named from its short antenna with very transverse flagellar segments.

DIFFERENTIAL DIAGNOSIS. *B. brevicornis* belongs to the *daira*-group of *Baryscapus*, with the mesosoma depressed dorsoventrally, scutellum weakly convex, with submedian lines nearer to sublateral lines than to each other, and antennae short with transverse flagellar segments. It resembles a number of species in this group which also attack Diptera Tephritidae but usually in Asteraceae heads rather than in galls. It differs from all known species by the presence of pale sutures on the vertex around the ocellar triangle (this character is discussed below), the propodeal spiracles separated from the metanotum by about one diameter (separated by 0.25-0.65x their diameter in most other species), and the more elongate mesosoma, 1.7-1.85x as long as broad (usually 1.4-1.5x, up to 1.7x in other species). In the keys by Graham (1991) *B. brevicornis* runs near *B. gradwelli* Graham, 1991, which is a parasitoid of Tephritidae in Asteraceae heads, with the mesoscutum lacking a median line and having a long propodeum, but it does not agree with other characters of this species. *B. brevicornis* differs from *B. gradwelli* in that the female antennae have more distinctly transverse flagellar segments (F1 subquadrate and F2 barely transverse in *B. gradwelli*), the flagellum is less broadened at the apex, the mesosoma is more elongate (1.5x as long as broad in *B. gradwelli*), the mesoscutal sculpture is coarser, the scutellum is less transverse with submedian lines less separated, enclosing a space 1.9-2.1x as long as broad (1.5-1.6x in *B. gradwelli*), the propodeal spiracles are more distant from the metanotum, and the gaster is less elongate and less acute. Males of *B. brevicornis* also run near *B. gradwelli* in the keys by Graham (1991), but they differ in the antennae, with flagellar segments very transverse and ventral plaque of scape slightly shorter (flagellar segments only slightly transverse, with pedicel plus flagellum 0.85x as long as breadth of mesoscutum, and ventral plaque about 0.5x length of scape in *B. gradwelli*).

B. brevicornis resembles *B. crassicornis* and *B. papaveris* in having similar short antennae with very transverse flagellar segments, in both sexes. It differs from both species in the mesoscutum lacking a median line (distinct to weak in *B. crassicornis* and *B. papaveris*), mesosoma more elongate with coarser sculpture, propodeum longer with spiracles more separated from metanotum, gaster usually shorter than head plus mesosoma (as long as, or longer in *B. crassicornis* and *B. papaveris*), and in having pale sutures on the vertex. *B. crassicornis*, a parasitoid of Coleoptera Curculionidae in Asteraceae heads, has a variable antennal shape, with a number of forms recently described (Yegorenkova *et al.*, 2011), but *B. brevicornis* differs from *B. crassicornis* in that the female funicle is less broadened at the apex, with F3 1.15-1.25x as broad as F1 (1.35x in *B. crassicornis*), the male antennae have the ventral plaque of the scape shorter and placed in the upper half (0.57-0.84x length of scape and extending over most of it in *B. crassicornis*), the temples are longer (0.38-0.43x length of eye; 0.15x in *B. crassicornis*), and the tibiae are dark (yellowish testaceous in *B. crassicornis*). *B. brevicornis* differs

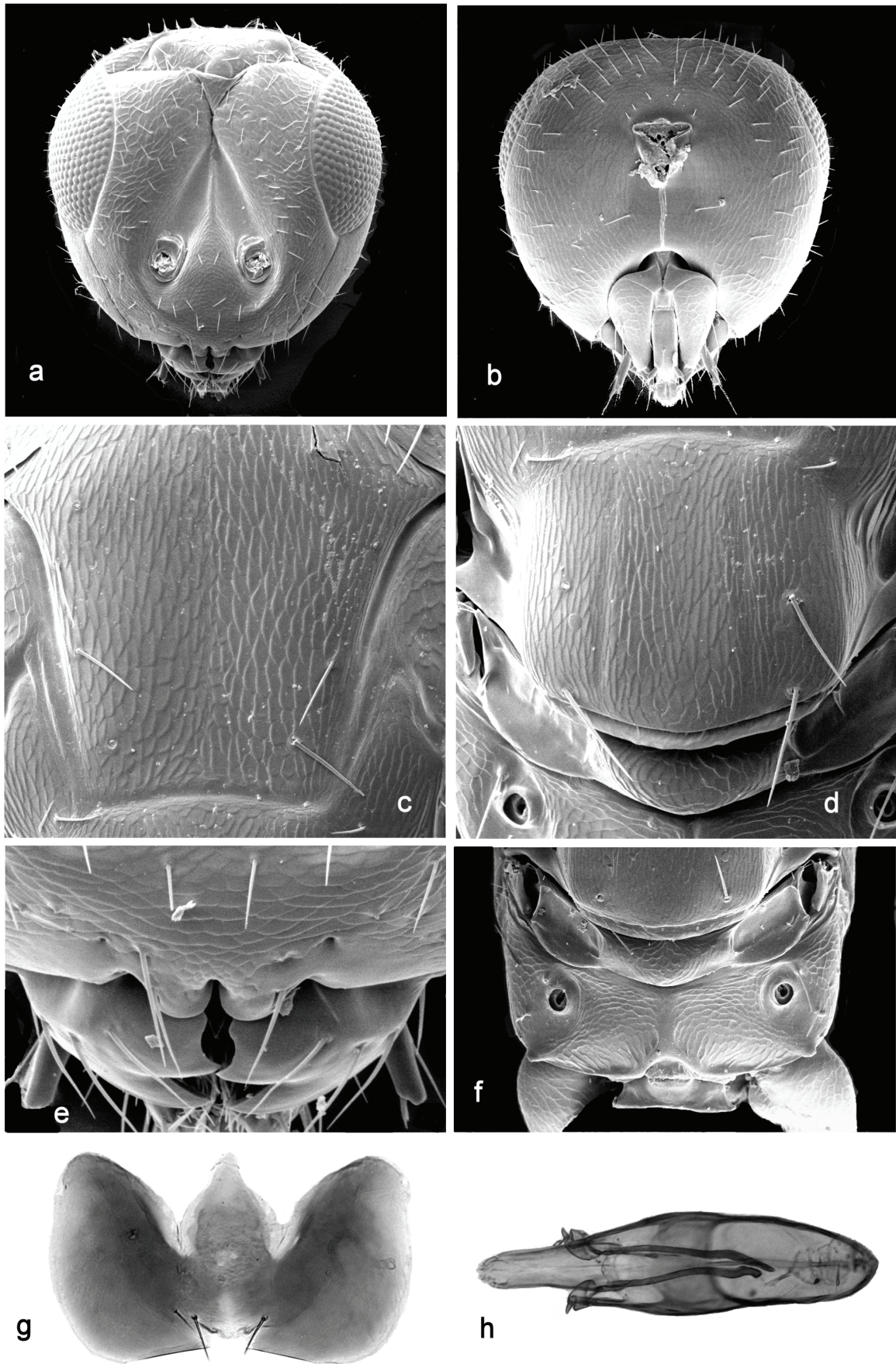


Fig. 2. *Baryscapus brevicornis* sp. n. **a-f:** female SEM microphotographs. **a)** head, frontal view; **b)** head, posterior view; **c)** mesoscutum; **d)** scutellum; **e)** clypeus and mandibles; **f)** propodeum; **g-h:** microscope slide microphotographs; **g)** female hypopygium; **h)** male genitalia. **Fig. 2.** *Baryscapus brevicornis* sp. n. **a-f:** hembra, microfotografías SEM. **a)** cabeza, aspecto frontal; **b)** cabeza, aspecto occipital; **c)** mesoscutum; **d)** escutelo; **e)** clipeo y mandíbulas; **f)** propodeo; **g-h:** fotografías en preparación microscópica; **g)** hipopigio de la hembra; **h)** genitalia del macho.

from *B. papaveris*, a parasitoid of Hymenoptera Cynipidae on *Papaver* with very similarly shaped antennae, in having dark scapes and tibiae (yellowish testaceous in *B. papaveris*), the gaster less acute with ovipositor sheaths not exerted (slightly projecting in *B. papaveris*), the male antennae having the ventral plaque of the scape shorter, and flagellum and clava being of about equal breadth (ventral plaque of the scape longer, and flagellum broadening distad, with clava about 1.4x as broad as F2 in *B. papaveris*), plus those differences previously stated shared with respect *B. crassicornis*.

COMMENTS. An unusual feature of *B. brevicornis* within the *daira* group of *Baryscapus* is the presence of pale sutures around the ocellar triangle, incomplete posteriorly, and a transverse suture reaching each eye. The pale sutures are more distinct in specimens dried after storage in ethanol, less so in air dried specimens. Similar incomplete sutures exist in *Aprostocetus* (*Argandia*) *gallicola* Nieves-Aldrey & Askew, 2011 (Nieves-Aldrey & Askew, 2011), a diagnostic character of subgenus *Argandia*, and also present in two gall-inducing Australian tetrastichine genera, *Oncastichus* LaSalle, 1995 and *Leptocybe* Fisher & La Salle, 2004. Other features of *Argandia* are the moderately large propodeal spiracles, placed close to the metanotum, and partially occluded by a flap of the callus, as in *Aprostocetus* Westwood, 1833, and a marginal vein that is widened at the base. Another genus recently described with sutures enclosing the ocellar triangle is *Zeytinus* Doganlar, 2011 (Doğanlar, 2011). In *Zeytinus* the sutures completely surround the ocelli without a posterior break and there is a shallow triangular fovea just outside each lateral ocellus, as in *Anaprostocetus* Graham, 1987. Both genera differ also from *B. brevicornis* in their antennal structure, *Zeytinus* also in the short hind basitarsus and the extensive pale, non metallic colour, and *Anaprostocetus* also in the presence of sharp paraspiracular carinae on the propodeum and a subdorsal carina on the hind coxae. Other genera having pale sutures on the vertex, although not identical, and a moderately flattened body habitus as in *B. brevicornis*, are *Pronotalia* Gradwell, 1957 and *Puklina* Graham, 1991. In *Puklina* the sutures are straight and continuous between the posterior ocelli and the eyes, and more distinctly yellowish marked, visible even in air dried specimens with collapsed heads. *Puklina* differs from the *daira* group of *Baryscapus* also in the lack of a hyaline break in the parastigma, mesosoma dorsally more flattened, usually with pale submedian lines on the scutellum, male antenna usually with whorls of long dark setae, and in being associated with *Bruchophagus* Ashmead, 1888 species in Asphodelaceae seeds. In *Pronotalia* the sutures around the ocellar triangle are straight and continuous between the posterior ocelli, and more variable in colour, sometimes being indistinct and not pale marked. An apparently undescribed species of *Pronotalia* from Spain has been seen, in which the sutures are identical to those of *B. brevicornis*, pale marked, curved behind posterior ocelli and incomplete posteriorly. *Pronotalia* is usually associated with Diptera Tephritidae, but it differs from *Baryscapus* in having the head with a frontal trapezoidal area instead of a median line, malar sulcus absent or indistinct, and antennae inserted much lower with shorter scapes. Other species in the *B. daira* group have been examined searching for similar sutures around the ocellar triangle. In *B. daira*, as well as in other species, a similar suture exists around the anterior part of the ocellar

triangle, but not or only shortly continuing posteriorly, and the straight, transverse suture is also present up to the eyes, but it is not pale marked and therefore inconspicuous. In *B. pallidae* these sutures may also be slightly pale marked in the anterior part of the ocellar triangle. In other characters *B. brevicornis* fits well into the *daira* group of *Baryscapus*. Therefore *B. brevicornis* is placed in the genus *Baryscapus* genus, as it does not fit well in other known genera, and considering that the character of the sutures on the vertex alone does not justify placement in a new genus if this character is not accompanied by other distinct features, and also having seen identical sutures in an undescribed *Pronotalia* species, and rudiments of these sutures in other *Baryscapus* species. With respect to the similarities in the shape of the vertex sutures between *Pronotalia* and *Puklina*, Graham (1991) indicates they may be due to convergence. The similarities in these sutures between *B. brevicornis*, *Aprostocetus* subgenus *Argandia* and the undescribed *Pronotalia* species, may also indicate convergence.

BIOLOGY. *B. brevicornis* is a gregarious endoparasitoid in the pupae of *Ptiloedaspis tavaresiana* Bezzi, 1920, a gall-former in lateral buds on *Artemisia herba-alba* stems (fig. 1h). These galls are known from Spain, from the provinces of Zaragoza (Los Monegros) (Merz & Blasco-Zumeta, 1995) and Almería (Medianero *et al.*, 2007), with the adult flies figured by Korneyev (2002). The galls have a long development time, and can be found together at several stages of development. Young galls containing growing *P. tavaresiana* larvae are small to medium size, and fully bracteate, covered with leaves. Mature galls in winter are bigger, the gall walls becoming more woody and their external surface is still covered with bracteate leaves; inside, the *P. tavaresiana* pupates in the cavity (fig. 1i). Older galls can be found with their woody walls naked, having lost all external leaves, sometimes still containing *P. tavaresiana* pupae. Occasionally the dry galls remaining on the stems are occupied by a successional fauna. *B. brevicornis* has usually been found by collecting mature or older naked galls in winter. A *P. tavaresiana* pupae was opened on 8.iv.2012 and found to contain many pale *B. brevicornis* pupae developing inside (fig. 1j). Later, on 30.v, these pupae were already mature and black, with some adults starting to emerge. A total of 24 specimens emerged from this pupa. From two other pupae, 28 and 23 specimens emerged, giving a mean of 25 *B. brevicornis* developing in a host pupa. It is possible that *B. brevicornis* acts as a hyperparasitoid via the primary parasitoids *Pteromalus almeriensis* or *Eurytoma* sp. nr. *robusta* in *P. tavaresiana* galls; the related species *B. gradwelli* has been recorded (Varley, 1947, as *Tetrastichus* sp.B) as both a primary parasitoid of Tephritidae and a hyperparasitoid via *Pteromalus elevatus* (Walker, 1834) and *Eurytoma robusta* Mayr, 1878.

Emergence dates from winter samples were usually between 8.iv and 15.v. It is not known if the species is univoltine, or bivoltine with another aestival generation. The related species *B. gradwelli* was found to be bivoltine (Varley, 1947), with one generation in June with emerging adults attacking old-standing flower heads, and another generation in August with emerging adults attacking fresh galls and later hibernating. The fact that *B. brevicornis* has been reared from winter samples composed of both mature 1st year galls and older, naked, possibly 2nd year galls, could be related to two generations being present, with the first emerging in May and

attacking mature *P. tavaresiana* pupae or the primary parasitoids *P. almeriensis* or *E. sp. nr. robusta*, and developing for a 2nd generation attacking young *P. tavaresiana* galls, or remaining in diapause up to the 2nd year of gall life. It could also, however, be related to a delayed development strategy as observed in other *Baryscapus* species and described by Askew & Shaw (2005). In the Tunisian species *B. bouceki* Askew & Shaw, 2005, a hyperparasitoid of Lepidoptera, the development as a koinobiont hyperparasitoid was delayed up to 21-35 months, and the prolonged diapause in this desert-inhabiting species was thought to be an adaptation to survive the failure of winter rains. A prolonged diapause in indoor conditions has not been observed.

The sex ratio of the specimens was strongly female biased. Of 832 specimens emerging from all samples, 91.1% were females and 8.9% males, in single samples usually varying between 86 and 96% females, exceptionally 70% females in one sample.

Other Tephritidae developing in galls on *Artemisia herba-alba* in Lleida province are *Oedaspis fissa* Loew, 1862 and *Campiglossa producta* (Loew, 1844), but *B. brevicornis* was not found in these galls.

Other parasitoids associated with *Ptiloedaspis tavaresiana* galls

Several other chalcid species were found associated with *P. tavaresiana* galls. Two species were also found associated with arthropods nesting in old empty galls. Not included here are some occasionally emerging parasitoids, usually of Diptera Cecidomyiidae or Hemiptera Coccoidea, which may be associated with hosts hidden in the plant samples.

Pteromalus almeriensis Gijswijt, 1999 (Pteromalidae)

A species described from Almería province, Spain, as a solitary ectoparasitoid of *P. tavaresiana* larvae (Gijswijt, 1999). It was also recorded from Los Monegros, Zaragoza province, Spain (Askew *et al.*, 2001) from the same host galls. Another *Pteromalus* species recorded from Los Monegros in *P. tavaresiana* galls, as *P. sp. indet C* (Askew *et al.*, 2001), is now considered to be also *P. almeriensis*, with a rather long female gaster but within the limits of variation of the species (R.R. Askew, in litt.).

MATERIAL EXAMINED: SPAIN, Lleida: 10 ♀♀, 10 ♂♂; Utxesa, UTM 31T BF99, 140m, 1 ♀, galls collected 12.iii.2008, emerged 24.iv.2008; Aitona, UTM 31T BF89, 2 ♀♀, 1 ♂, galls collected 19.xii.2007, emerged 29.ii.2008; Montoliu, UTM 31T CG01, 1 ♀, galls collected 19.i.2008, emerged 29.iii.2008; Montoliu, 1 ♀, 1 ♂, galls collected 18.iii.2011, emerged 18.iv.2011; La Granja d'Escarp, UTM 31T BF78, 90m, 3 ♀♀, 1 ♂, galls collected 31.xii.2007, emerged 1.ii.2008 (forced); La Granja d'Escarp, 2 ♀♀, 7 ♂♂, galls collected 20.iii.2012, emerged 25.iv-13.v.2012.

Eurytoma sp. nr. robusta Mayr, 1878 (Eurytomidae)

E. robusta is a parasitoid of Tephritidae in Asteraceae heads. This form developing in *P. tavaresiana* galls was also recorded from Los Monegros, Zaragoza province, Spain (Askew *et al.*, 2001), as *E. sp. nr. robusta*. Specimens reared from this galls in Lleida province are also similar to *E. robusta*, with the same gaster shape, but have a number of differences, such as marginal vein longer than postmarginal,

propodeum with fine reticulate sculpture on medial panels, mesopleuron not or barely striate, eyes smaller, etc. This is probably an undescribed species in the *robusta* group.

MATERIAL EXAMINED: SPAIN, Lleida: 6 ♀♀, 9 ♂♂; Utxesa, UTM 31T BF99, 140m, 2 ♂♂, galls collected 4.i.2011, emerged 2011; La Granja d'Escarp, UTM 31T BF78, 90m, 2 ♀♀, 1 ♂, galls collected 31.xii.2007, emerged 29.ii.2008 (forced); Alcanó, UTM 31T CF06, 4 ♀♀, 6 ♂♂, galls collected 29.ii.2012, emerged 27.iii-8.iv.2012.

Eurytoma trypticola Zerova, 1978

E. trypticola was described as a parasitoid of *Oedaspis multifasciata* (Loew, 1850) galls in *Artemisia maritima* L. in Ukraine. It also belongs to the *robusta* group, but has a more distinctly elongate gaster, with a very long 7th tergite, twice as long as the 6th tergite, and propodeum with fine reticulate sculpture on medial panels. Several specimens agreeing with the description of this species emerged from *P. tavaresiana* galls. They have a similarly elongate 7th tergite, but there are very small differences in gaster and head proportions. They are probably conspecific with *E. trypticola*, having a very similar host, and show only regional variation. This is the first Spanish record of the species and extends the known distribution of *E. trypticola*. Mature larva were seen in galls dissected 17.i.2011, which later pupated and emerged as adults on 18-29.iv.2011.

MATERIAL EXAMINED: SPAIN, Lleida: 2 ♀♀, 2 ♂♂; Utxesa, UTM 31T BF99, 140m, 1 ♀♀, 2 ♂♂, galls collected 9.iv.2010, emerged 18-29.iv.2011; Utxesa, 1 ♀, sweeping *Artemisia herba-alba*, 1.iv.2011.

ADDITIONAL MATERIAL: SPAIN, Zaragoza: 1 ♀, Pina de Ebro, UTM 30T YL29, from galls collected 10.iv.1992 on *Artemisia herba-alba* subsp. *valentina* (leg. J. Blasco-Zumeta). This specimen was not included in the catalogue of Los Monegros (Askew *et al.*, 2001), and has been now seen to share the same characters of this species (R.R. Askew, in litt.).

Torymus canariensis Hedqvist, 1977 (Torymidae)

T. canariensis was described as a parasitoid of unidentified Cecidomyiidae galls on *Artemisia thuscula* Cav. (= *A. canariensis* (Besser) Less.) (Hedqvist, 1977). Later it was also recorded from *Ptoelidaspidis tavaresiana* (sic) galls in peninsular Spain, with specimens of varying size emerging from galls, possibly either as a primary parasitoid of *P. tavaresiana*, or as a parasitoid of inquiline gall midges (Graham & Gijswijt, 1998). This species has been commonly found in Lleida province, also in the Los Monegros region (Askew *et al.*, 2001), always emerging from other Cecidomyiidae galls on *Artemisia herba-alba*, and not emerging from *P. tavaresiana* galls.

Cratomus megacephalus (Fabricius, 1793) (Pteromalidae)

A species with biology unknown, but possibly associated with xylophagous Coleoptera or Hymenoptera nesting in wood. Two specimens emerged from a sample containing some old empty galls, possibly also used as a nesting cavity by a hymenopterous host. In another sample, one specimen of Eumeninae (Hymenoptera: Vespidae) emerged from a nest in old galls.

MATERIAL EXAMINED: SPAIN, Lleida: 1 ♀, 1 ♂, La Granja d'Escarp, UTM 31T BF78, from galls collected 31.xii.2007, emerged 11-16.v.2008.

Gelis* sp. gr. *bicolor (Villers, 1789) (Ichneumonidae)

The species of this group are usually parasitoids in Arachnida egg-sacs (Schwarz, 2002). One specimen emerged from a sample containing old empty galls. In the same sample, four of the open galls were found to contain unidentified Salticidae nesting inside.

MATERIAL EXAMINED: SPAIN, Lleida: 1 ♀, La Granja d'Escarp, UTM 31T BF78, from galls collected 20.iii.2012, emerged 8.iv.2012.

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