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# A NEW *BARYSCAPUS* FÖRSTER (HYMENOPTERA: EULOPHIDAE) PARASITIC ON *DIORHABDA ELONGATA* BRULLÉ (COLEOPTERA: CHRYSOMELIDAE) AND IMPLICATIONS FOR THE BIOLOGICAL CONTROL OF SALTCEDAR (TAMARICACEAE: *TAMARIX* SPP.) IN THE SOUTHWESTERN UNITED STATES

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*Abstract.*—***Baryscapus diorhabdivorus* Gates and Myartseva, new species,** (Hymenoptera: Eulophidae) is described and illustrated. This species was reared from the saltcedar leaf beetle, *Diorhabda elongata* Brullé (Coleoptera: Chrysomelidae), in Turkmenistan. It is compared to closely related species, and its implications for the biological control of *Tamarix* spp. are discussed.

*Key Words:* Hymenoptera, Eulophidae, *Baryscapus, Diorhabda, Tamarix,* biocontrol

The genus *Baryscapus* Förster contains over 130 nominal species worldwide whose biologies are quite diverse in terms of host taxa and life stages attacked (Graham 1991, LaSalle 1994, Noyes 2001). This is the first record of *Baryscapus* attacking the chrysomelid *Diorhabda elongata* Brullé (saltcedar leaf beetle), but not the first record for species of *Baryscapus* attacking the family Chrysomelidae. *Baryscapus chlamytis* Ashmead parasitizes the eggs of *Chlamisus* spp., *Neochlamisus platani* (Brown), and *Exema* spp. *Baryscapus microrhopalae* Ashmead is known from larvae/pupae of *Microrhopala* spp., and *B. erynniae* Domenichini is both a larval/pupal hyperparasitoid of Tachinidae and a primary parasitoid on *Pyrrhalta luteola* (Müller). The saltcedar leaf beetle has been released recently in the western United States as part of a biological control program against invasive *Tamarix* spp. (Tamaricaceae) (DeLoach, personal communication). A new species of *Baryscapus* was discovered parasitizing the saltcedar leaf beetle in Turkmenistan, the source of introduction into the United States. Some background information, presented below, is necessary to place the potential importance of this new species into context in terms of biological control programs of *Tamarix* spp. in the western United States.

The economic impact of this new parasitoid, were it to be inadvertently introduced into the United States, could be significant because its host has been released and established in at least five western states: California; Colorado; Nevada; Utah; and Wyoming (released but not established in Texas), for the control of *Tamarix* spp. (DeLoach, personal communication). Releases in Arizona and New Mexico are on

hold until the results of the other test releases are known, because saltcedar has supplanted native willow (*Salix* spp.) in riparian areas in these areas and has become a common nesting site for an endangered bird, the southwestern willow flycatcher.

The Old World genus *Tamarix* consists of 54 species found from southern Europe to Central Asia. Approximately 10 species were introduced into the United States in the early 1800s as ornamentals, windbreaks, or to stabilize soil. *Tamarix parviflora* DC. and *T. ramosissima* Ledeb. have displaced native willows and cottonwoods (*Populus* spp.) in nearly every riparian area in the western United States. These species occupy >1.5 million acres, with *T. parviflora* confined to coastal and central California and *T. ramosissima* found in arid inland regions. Saltcedar is disruptive for many reasons: 1) It uses twice as much water as native vegetation; 2) it draws salt from deep in the soil and deposits it on the surface, eliminating understory plants; 3) it interferes with access to public and private rivers and lakes; 4) it causes flood damage by impeding flow during high water stages; 5) it burns easily, which favors saltcedar over native riparian vegetation due to rapid regrowth; and 6) and its dense roots and rhizomes spread out, slow river flow, increase siltation and can result in rechannelization (Baum 1978, Everitt 1980, Truman 1996, Weisenborn 1996).

Larval and adult populations of *D. elongata* effectively defoliate saltcedar as a larva and adult with complete defoliation of *T. raimosissima* by *D. elongata* documented in Kazakhstan and Turkmenistan (DeLoach 2001). Field cage trials began in 6 western US states in 1999 and open field releases began at 6–7 sites in May, 2001. Success has ranged from partial to complete defoliation upon establishment (DeLoach, personal communication). Adults produce at least two generations per year, depending on conditions. Adults only eat green vegetation, creating holes in the leaves through which water escapes, causing branches to wither and die. The beetles appear to aestivate south of the 38° parallel during mid summer, reducing their effectiveness. As *Tamarix* has no close relatives in North America, exotic biological control candidates that feed on saltcedar are unlikely to find suitable native American food plants or crops and become pests. Similarly, *B. diorhabdivorus,* n. sp., might also attack related chrysomelid taxa in the New World were it to be introduced. Unfortunately, not enough is known about the host range of species of *Baryscapus* that attack chrysomelids to speculate on this.

Abbreviations used are USNM (National Museum of Natural History, Smithsonian Institution, Washington, DC), BMNH (The Natural History Museum, London), and ZIN (Zoological Institute, Kiev, Ukraine).

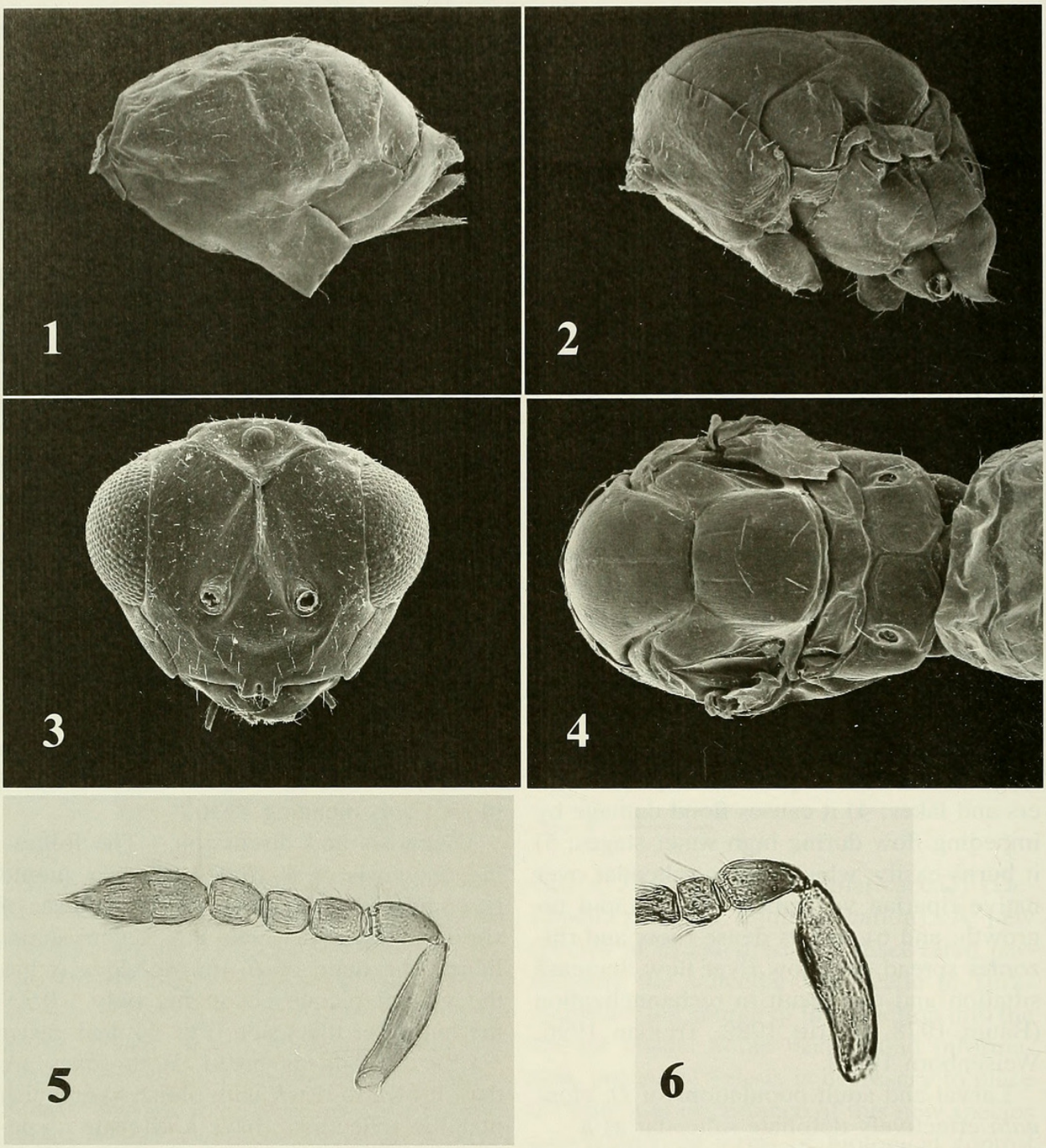
### *Baryscapus diorhabdivorus* Gates and Myartseva, new species

(Figs. 1–6)

Etymology.—Named for the host genus of Chrysomelidae, *Diorhabda,* and the Latin root *vor,* meaning "eat."

Diagnosis and discussion.—The following diagnosis of *B. diorhabdivorus* should be compared to the subsequent diagnoses of similar species that also attack Chrysomelidae. The male of *B. diorhabdivorus* has the ventral plaque occupying only ~0.3× the length of the scape (Fig. 6), and gaster ~1.8× as long as broad. Both sexes are dark brown to black with bluish to greenish metallic reflections; have a bilobate clypeus; stouter stigmal veins; 3–4 adnotaular setae on the mesoscutum, and a fine median line (Figs. 2, 4); tibial banding on all legs; and the propodeal spiracle in a teardrop-shaped depression (Fig. 4).

*Baryscapus microrhopalae:* dark with metallic blue reflections, male scape with longer ventral plaque occupying ~0.5× its length; clypeus not bilobate; more slender stigmal vein; propodeal spiracle not in teardrop-shaped depression; male with a more elongate gaster with longer first gastral tergum; tibial banding only on hind leg.




Figs. 1–6. *Baryscapus diorhabdivorus.* 1, Lateral view of gaster, female. 2, Lateral view of mesosoma, female. 3, Anterior view of head, female. 4, Dorsal view of mesosoma. 5, Antenna, female. 6, Scape, male.

*Baryscapus chlamytis:* brown with very faint metallic (blue/purple) reflections; male scape with ventral plaque in medial half and occupying 0.3–0.5× its length; clypeus shallowly bilobate; more gracile and shorter stigmal vein rounded apically with finer uncus; propodeal spiracle not in teardrop-shaped depression; only two adnotaular setae, very faint median line on mesoscutum.

*Baryscapus erynniae:* extensive bright metallic green reflections; male scape with ventral plaque in basal half and occupying ~0.5× its length; clypeus truncate; more slender stigmal vein; propodeal spiracle not

in teardrop-shaped depression; male with anterior third of gaster translucent brown; tibial banding on all legs; sometimes beginnings of second row (1–2 only) of adnotaular setae anteromedially, distinct median line on mesoscutum.

Herein we place *B. diorhabdivorus* in Graham's (1991) key and compare it diagnostically with other species of *Baryscapus* associated with Chrysomelidae. This species may mistakenly key to *B. servadeii* (Domenichini) (couplet 9) IF the gaster is collapsed and the hypopygium appears to extend to 0.7–0.73× the length of the gaster. However, unlike *B. servadeii,* the malar sulcus of *B. diorhabdivorus* is not strongly curved. Continuing beyond couplet 9' requires that IF the hypopygium is
situated beyond the middle of the gaster, then there are OFTEN >1 rows of adnotaular setae (only one row in *B. diorhabdivorus*), thus it is possible to proceed. *Baryscapus diorhabdivorus* ultimately keys to couplet 37. This result is obtained by proceeding through the following couplets: 10'—clava <4.2–4.3× as long as broad, mesoscutum with median line; 11'—gaster <2.0× as long as head + thorax; 12'—pedicel+flagellum <1.4× as long as width mesoscutum; 13'—gaster not strongly acuminate and ≤1.5× as long as thorax; 19'—all funiculars not distinctly longer than broad; 20'—gaster at least 1.5× as long as broad; 21'—F1 not at least 1.5× as long as broad; 34'—pedicel + flagellum usually at least as long as width mesoscutum, host not *Quercus* (Fagaceae); 35'—antennal clava lacking prominent spine; 36—gaster 1.5–2.1× as long as broad with last tergite broader than long), after which it would come out near *B. obesulus* Graham (couplet 38). However, *B. diorhabdivorus* does not quite match the characters of *B. obesulus* in which the gaster is longer and the propodeum is greater than 0.25× the length of the scutellum. Furthermore, *B. obesulus* is only known from France and Sweden from unknown hosts.

Description.—Female: Length 1.1–1.7 mm. *Color:* Body dark brown to black, with dark greenish-blue metallic reflections; lateral surfaces of mesosoma, coxae and gaster lustrous brown with faint metallic reflections. Antenna yellow, scape and pedicel basally slightly darkened. Legs yellow, except femora in basal ⅔ and pretarsomeres brown. Fore wing hyaline, veins light yellow, setae on disk short and sparse.

*Head:* Lineolate to finely reticulate, occipital region imbricate, slightly broader than thorax, 1.2–1.3× as broad as high, sparse setation ventrad toruli and laterad scrobal depression. Scrobal depression shallow with fine intrascrobal carina in apical half, converging at "V" of frontal arms. Eye 1.6–1.8× as long as malar space. Malar sulcus slightly curved. Posterior ocelli placed on margin of vertex, separated from dorsal eye margin by 1.4× ocellar diameter and from each other by 3.0× ocellar diameter. Distance between posterior ocelli ~2.0× greater than between lateral ocellus and eye margin. Scrobes connected dorsally, converging with fine intrascrobal carina and frontal arms. Toruli level with lower margin of eyes, separated by ~2.0× torulus diameter. Clypeus bilobate (Fig. 3). Width of oral fossa equal to 0.67× width of head.

*Antenna:* Scape 3.8–4.5× as long as broad, pedicel 1.4–1.8× as long as broad. Anellus transverse. Funicles roughly quadrate to longer than broad, F1 0.8–1.2× as long as broad; F2 0.8–1.0× as long as broad. Clava 3-segmented, slightly wider than funicle, 2.5–3.4× as long as broad (Fig. 5).

*Mesosoma:* Pronotum short, transverse, finely reticulate with row of distinct setae along apical margin. Mesoscutum 1.1–1.5× as long as broad, dorsally lineolate and becoming more broadly lineolate to reticulate on lateral surfaces of mesoscutum and scutellum, with median line and with a single row of 3–4 adnotaular setae (Figs. 2, 4). Scutellum 0.8× as long as broad; submedia and sublateral lines present, submedial lines distinct and closer to each other than either is to sublateral line; 2 pairs setae laterad of

submedial lines, anterior seta placed near middle of scutellum and ~1.0× setal base diameter from submedial line, posterior seta placed near posterior edge of scutellum and ~2.0× setal base diameters from submedial line; circular placoid sensillum present approximately midway to just anteriad of midpoint between scutellar setae. Metanotum transverse, rounded medially, with faint reticulate sculpture, ~0.5× length of propodeum. Propodeum faintly reticulate with fine median carina; spiracles ~0.5× their diameter from anterior margin of propodeum, located in shallow, teardrop-shaped depression that tapers posteriorly, two long setae just anterolaterad and one long seta posterad of spiracle above base of metacoxa (Fig. 4). Prepectus finely imbricate, mesopleuron glabrate dorsally becoming finely imbricate-reticulate ventrally, femoral depression shallow, arcuate. Metacoxa ~2.0× as long as mesocoxa, broadest medially, finely imbricate.

*Wing:* Fore wing 2.0–2.1× as long as broad, marginal fringe short, setation sparse and fine. Submarginal vein with three dorsal setae, two in basal third and one at midpoint, 0.9–1.1× as long as marginal vein. Marginal vein 7.0–10.0× as long as postmarginal vein and 2.5–3.0× as long as stigmal vein. Stigmal vein slightly less than 3.0× times shorter than marginal vein. Basal portion of fore wing glabrous.

*Metasoma:* Gaster 1.8–2.0× as long as broad (uncollapsed specimens), finely reticulate-imbricate, each tergum with single, transverse row of setae near apex of tergite; hypopygium extending ~0.7× length of gaster. Ovipositor sheaths exserted, but barely visible in dorsal view (Fig. 1).

Male: Length 0.9–1.0 mm. Similar to female in coloration and structure except as follows: Scape 3.0× as long as broad with ventral plaque in apical third (Fig. 6). Anellus transverse. F1 0.8× as long as broad, F2 1.2× as long as broad; clava 3.5× as long as broad. Setae of flagellomeres as long as width of corresponding segment. Gaster 1.8× as long as broad. Genitalia (phallobase) slightly more than 3.0× longer than its width. Digital sclerites slightly less than 6.0× shorter than phallobase, with one thin tooth apically, their length equal to length of parameres and slightly enlarged to apex (in dried specimens).

Type material.—Holotype ♀. Turkmenistan: Dry Sport Lake, 22.ix.1996, S. Myartseva, *ex* adults of beetle *Diorhabda elongata* (USNM). Paratypes 14 ♀, 1 ♂, same data as holotype (10 ♀, 1 ♂, USNM; 2 ♀ BMNH; 2 ♀ ZIN). The exact location of Dry Sport Lake is unknown, though apparently in the vicinity of Ashgabat.

Other material.—Turkmenistan: Ashgabat and vicinity, 1.x.1993, S. Myartseva, *ex* larvae of beetle *Diorhabda elongata* Brullé on *Tamarix* spp. (3 ♀ 1 ♂ USNM); 3.ix.1994 (2 ♀); 19.viii.1994 (3 ♀); 1.x.1994 (1 ♂); 8.x.1993 (4 ♀) (all USNM).

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