

VERBASCUM GAILLARDOTII BOISS. AND ITS NATURAL ENEMY COMPLEX IN HATAY PROVINCE, TURKEY

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ABSTRACT: *Verbascum gaillardotii* Boiss. and its natural enemy complex in Hatay province, Turkey have been studied. Diagnostic characters and distribution in Turkey was given. The natural enemy complex of the flat-margined mullein was given for the first time from Hatay, Turkey. The natural enemies are: *Rhinusa tenuirostris* (Stierlin, 1888), *Rhinusa tetra* (Fabricius, 1792) (Coleoptera: Curculionidae), *Melitaea trivialis* (Denn. & Schiff.) (Lepidoptera: Nymphalidae), *Cucullia verbasci* L., the mullein moth, (Lepidoptera: Noctuidae), *Asphondylia verbasci* (Vallot, 1827) (Diptera: Cecidomyiidae). The hymenopter parasites of plant-feeders are: *Entedon sparetus* Walker (Eulophidae), *Calosota* sp. (Eupelmidae), and 2 spp. of Ichneumonidae (reared from galls of *R. tenuirostris*), *Torymus verbasci* Ruschka, 1921 (Torymidae) (reared from galls of *A. verbasci*).

KEY WORDS: *Verbascum gaillardotii* natural enemies, Hatay, Turkey.

The gaillardot's mullein, *Verbascum gaillardotii* Boissier, 1959, (Scrophulariaceae) was first described from Lebanon. The species was recorded from Turkey by Özçelik & Çetinkaya (2002 in Isparta, and TÜBİVES in Hatay). Nesom (2012) recorded the species as *Verbascum sinuatum* L., ssp. *gaillardotii* (Boissier) Bornmueller from Syria, Lebanon and Palestine, gave the differences from *Verbascum sinuatum* L., ssp. *sinuatum*.

There is not any record on natural enemy of the gaillardot's mullein, however Caldara et al. (2012) stated that *Rhinusa* spp. in the *R. tetra* species group feeding on several species of *Verbascum*, and gave an identification key for 5 species. Sert & Çağatay (1999) gave *Rhinusa tenuirostris* (Stierlin, 1888) as a synonym of *Gymnetron asellus* Gravenhorst, 1807. Caldara et al. (2010) carried out a phylogenetic analysis of the species belonging to the weevil genus *Rhinusa* Stephens, 1829 (Coleoptera: Curculionidae: Curculioninae: Mecinini), and transferred *Gymnetron bodenheimeri* H. Wagner, 1926 to *Rhinusa* as a distinct species, later Caldara (2013) synonymized it under *R. tenuirostris*.

Gokman & Gumovsky (2013) gave *Entedon sparetus* Walker as parasitoid of *Rhinusa asellus* (Gravenhorst) on mullein, *Verbascum* sp.

Anonymous (2014) gave diagnostic characters, hosts and biological data of *Melitaea trivialis* (Denn. & Schiff.) and *Cucullia verbasci* L.

Larvae of *Asphondylia verbasci* (Vallot, 1827) change the flower buds of *Verbascum nigrum* L. and *V. sinuatum* (Scrophulariaceae) to galls (Tavares, 1902, 1905; Cogolludo, 1921; Vilarrubia, 1936; Sukhrava et al., 2006).

Aim of the current work is to find out the diagnostic characters of *V. gaillardotii*, and the species in its natural enemy complex in Hatay province, Turkey, and to give some morphological and biological aspects of the species which will be helpful in biological control of *V. gaillardotii*,

MATERIALS AND METHOD

The gaillardot's mullein was collected to obtain the several stages in development periods in 2012 and 2013, and their photos were taken for taxonomic works.

In the period from September, 2012 to March, 2013, the galls of *R. tenuirostris* on *V. gaillardotii* were collected from several regions of Hatay province of Turkey. The regions are: Hatay: Altınözü, Hanyolu and Yanıkpinar villages, Antakya, Yayladağ, Şenköy. The galls collected were brought to laboratory, placed in the cages and kept under the conditions of 50-60% relative humidity and about 15-20 °C. Some of galls were dissected to obtain specimens of larvae and pupae. To rear adult midges in the bud galls of *V. gaillardotii* galls were collected in April and May, 2013, and were brought to laboratory, placed in the plastic bags under same conditions stated above. The adults came out of the galls were killed in 97% ethanol and put into vials with ethanol. Taxonomic works were carried out under microscopes, and photographs of diagnostic characters of the species were taken by using a stereo-microscope with a digital camera attached to it.

The identification of the gaillardot's mullein was done by following the key of Nesom (2012) by the second author; *Rhinusa tenuirostris* was identified by Dr. Roberto Caldara (via Lorenteggio 37, 20146 Milano, Italy. E-mail roberto.caldara@gmail.com); the other plant feeder species were identified by Dr. Ivo Tosevski (Institute for Plant Protection and Environment, Banatska 33, 11080 Zemun, SERBIA, E-mail: tosevski_ivo@yahoo.com); the parasitoids were identified by the first author.

RESULTS AND DISCUSSION

Verbascum gaillardotii Boissier, 1859

Syn. *Verbascum sinuatum* L., ssp. *gaillardotii* (Boissier) Bornmueller (Nesom, 2012).

The species very similar to *Verbascum sinuatum* L., the description of which was given in detail by Nesom (2012). The plants in Hatay province should be *V. gaillardotii* having narrower bracts and bracteoles, slightly smaller corollas, 4(--5) stamens and flat-margined leaves (in *V. sinuatum* with broader bracts and bracteoles, bigger corollas, 5(--4) stamens and wavy leaves) (Fig. 1).

The habitus, inflorescences and seed capsules as seen in Fig. 2.

Distribution: In Turkey: Hatay. In the world: Syria, Lebanon, Palestine.

Syn. *Verbascum sinuatum* L., ssp. *gaillardotii* (Boissier) Bornmueller (Nesom, 2012).

Natural enemy complex *Verbascum gaillardotii*

Rhinusa tenuirostris (Stierlin, 1888)

Syn. *Gymnetron bodenheimeri* H. Wagner, 1926. (Caldara, 2013)

Sert & Çağatay (1999) gave *Rhinusa tenuirostris* (Stierlin, 1888) as a synonym of *Gymnetron asellus* Gravenhorst, 1807. Caldara et al. (2010) transferred

Gymnetron bodenheimeri H. Wagner, 1926 to *Rhinusa* as a distinct species, later Caldara (2013) synonymized it under *R. tenuirostris*.

Diagnosis: body with long rostrum (Figs. 3a,b); rostrum of male in lateral and dorsal views of the same width from base to apex (Figs. 3a,b and 8-9 of Caldara et al., 2012), in dorsal view striate-punctate without larger median sulcus; rostrum of female in lateral and dorsal views parallel-sided (Fig. 3c); antenna clubbed with 4+3 flagellar segments (Fig. 3d); abdomen with 6 sternites (Fig. 3f); uncus of metatibiae of male pointed at apex, and tibiae with outer margin distinctly curved outwards near apex (Fig. 3e). Legs with claws fused basally (Fig. 3g); spiculum ventrale almost Y-shaped (Fig. 4a); aedeagus very long, parallel-sided to near apex (Fig. 4b); spermatheca and tip of gaster as in figs. 4c,d.

Material studied: Hatay, Turkey: 12 females; 7 males, Altınözü, Hanyolu, 05-23 March, 2012, 15 females, 11 males, Yanıkpınar villages, 27 February- 13 March, 2013; 3 females, 2 males, Center of Antakya, 10- 22 March, 2013. All of the specimens were reared from galls on *V. gaillardotii* by M. Doğanlar.

Biology: Up to now there was not any biological data about this species under both names. By this work its biology in Hatay province, Turkey was studied. The results as follows:

The adults overwintered under shelters of debris. In early spring adults started to feed on newly developed stems and branches by inserting very long rostrum and open deep holes (Fig. 5).

After copulation the matured eggs were laid onto opening of the feeding holes. Later hatching take place, the first instar larvae (5-12) start to feed on sides of the hole, and induce gall, than stem thickening (Fig. 6a) which later become a globular gall in several shapes (Figs. 6b-d).

Many weevil larvae in different stages can be found in the galls. Development of the larvae has continued in Summer and Autumn. At the end of Autumn the larvae have pupated and diposed in Winter. The galls with pupae were collected and brought to the laboratory in February. At the beginning of March, after a few days the adults of *R. tenuirostris* come out from the galls by opening an exit hole, 3-4 mm in diameter (Fig. 7). The emergence of adults from galls has continued up to the end of April. At the beginning of March the adults can also be seen on the newly developed *Verbascum* stems in the field.

Parasitoids: *Entedon sparetus* Walker (Eulophidae), *Calosota* sp. (Eupelmidae), and 2 spp. of Ichneumonidae. *Entedon sparetus* was also reared from *Rhinusa asellus* (Gravenhorst, 1807) (Gokman & Gumovsky, 2013).

***Rhinusa tetra* (Fabricius, 1792)**

Synonyms were given by Caldara et al. (2012).

Diagnosis: Rostrum of male in lateral and dorsal views gradually but distinctly tapering from base to apex, moderately elongate (length/width at base 3.8-4.4, average 4.0; rostrum length/pronotum length male 0.84-0.97, average 0.90 (Figs. 8a,b), in dorsal view at least at antennal insertion with large median sulcus deeper than lateral ones; rostrum of female in lateral and dorsal views either gradually narrowing from base to apex or parallel-sided, length/width of rostrum at base 4.3-5.2, average 4.6; rostrum length/pronotum length 0.95-1.07, (average 1.01) (Fig. 8c); aedeagus shorter, sinuous at middle and then gradually narrowing to apex (Fig. 8d); female with scrobe distinctly visible in dorsal view (Fig. 8c).

Biology: Larva and adult were quoted to be collected on various species of *Verbascum*. Such as: *V. blattaria*, *V. boerhavia*, *V. creticum*, *V. lychnitis*, *V.*

nigrum, *V. phlomoides*, *V. phoeniceum*, *V. pulverulentum*, *V. speciosum*, *V. thapsiforme*, *V. thapsus* Sometimes adult *R. tetra* were collected also on *Scrophularia* (*S. auriculata*, *S. canina* (Caldara et al. 2012). Introduced in North America where it was proposed as a potential candidate for the biological control of invasive common mullein, *Verbascum thapsus* L. (O'Brien & Wibmer 1982).

Distribution. Europe, Siberia, North Africa, Middle East, central Asia, northern India (R. Caldara, pers. comm.).

Material studied: 6 females, 2 males, Hatay, Altınözü, Hanyolu village, 02 June, 2013, feeding on seed capsules of *V. gaillardotii*, by M. Doğanlar.

Asphondylia verbasci (Vallot, 1827)

Fedotova (2004) gave description of adults and the figures of diagnostic characters.

Skuhrava et al. (2012) stated that larvae change the flower buds into galls of *Verbascum nigrum* L. and *V. sinuatum* (Scrophulariaceae). In Hatay province the midges lay its eggs on buds, after hatching the larva enter into the bud and feed on the generative organs. The bud form the gall (Fig. 9) and larva pupated and adult emerged from the gall. Infestation by *A. verbasci* was not so high, about 5-10%.

Distribution: Hatay, Altınözü, Hanyolu village; Antakya and Harbiye; Yayladağ, Şenköy.

Parasitoids: *Torymus verbasci* Ruschka, 1921 was reared on 11 females and 7 males from 70 galls collected from Harbiye. Parasitism level was about 25%, but in other regions parasitism was not higher than 5%.

Beside of those species the following species of Lepidoptera feeding on leaves and buds of *V. gaillardotii* in several parts of Hatay province: *Melitaea trivialis* (Dennis. & Schiffer.) (Lesser Spotted Fritillary), and *Cucullia verbasci*, The mullein moth, (Lepidoptera: Noctuidae).

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Figure 1. *Verbascum* spp. a, b. *V. sinuatum* L., 1753, a. flowers with 5 anthers, b. first year of plant with wavy leaves; c, d. *V. gaillardotii* Boissier, 1859, a. flowers with 4 anthers, b. first year of plant with flat-margined leaves



Figure 2. Several stages of *Verbascum gaillardotii* Boissier, 1859.

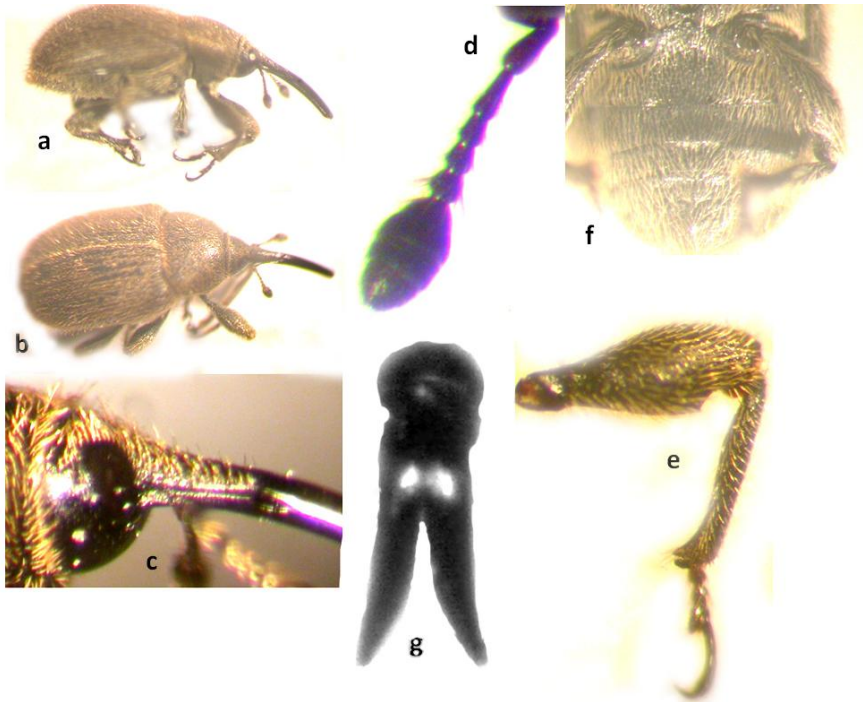


Figure 3. *Rhinusa tenuirostris* (Stierlin, 1888). Female. a, b. body. a. in lateral view, b. in dorsal view; c. base of rostrum; d. antenna; e. fore leg, except coxa, in lateral view; f. abdomen, in ventral view; g. claws, in dorsal view.

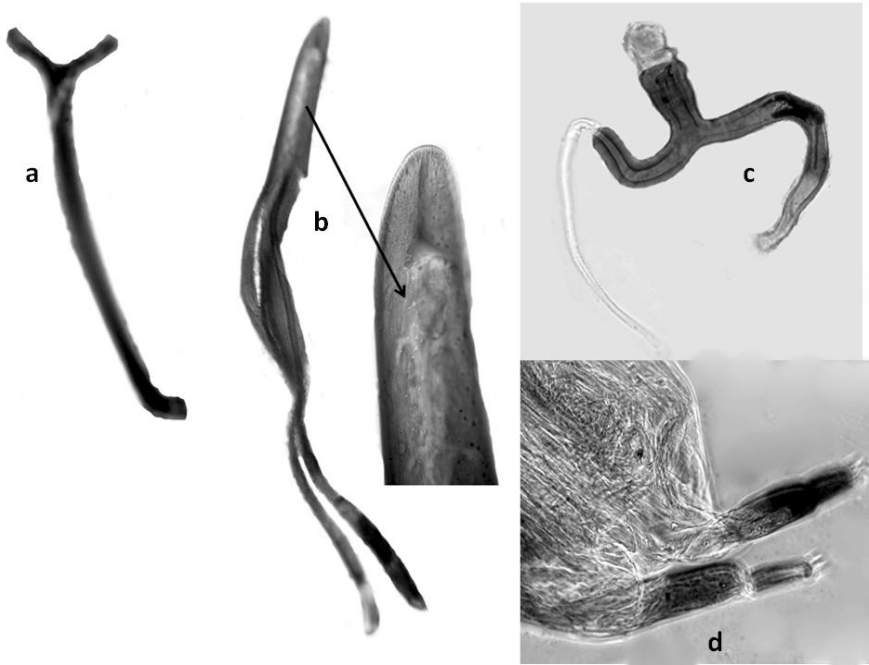


Figure 4. *Rhinusa tenuirostris* (Stierlin, 1888). a-b. male. a. spiculum ventrale; b. aedeagus in lateral view, with apical part in dorsal view; c-d. female. c. spermatheca; d. tip of gaster.



Figure 5. Feeding holes of *Rhinusa tenuirostris* (Stierlin, 1888). a, b. base of stem; c. apical part of stem.



Figure 6. Several stages of gall formation by *Rhinusa tenuirostris* (Stierlin, 1888). a. early stage to f. mature galls.

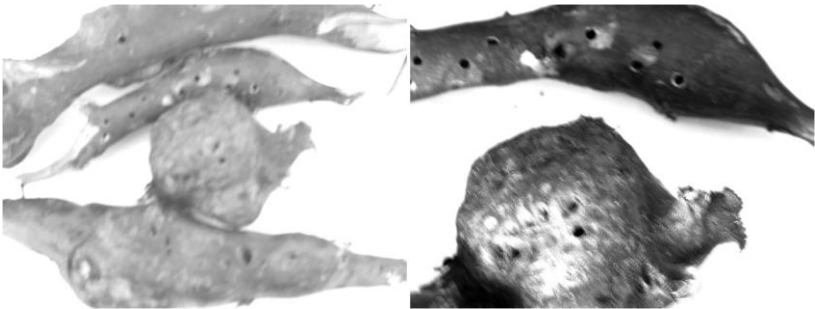


Figure 7. Several galls with exit holes of *Rhinusa tenuirostris* (Stierlin, 1888).

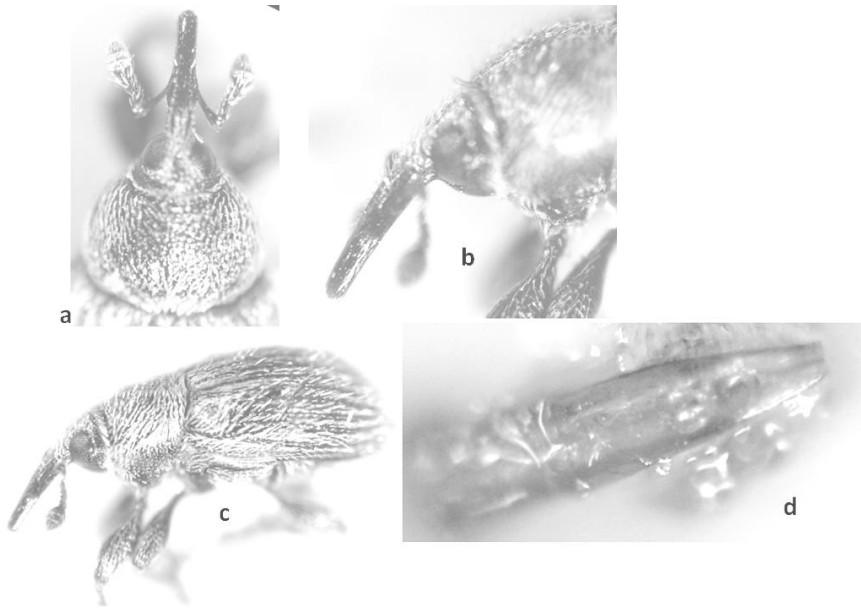


Figure 8. *Rhinusa tetra* (Fabricius, 1792). a, b. pronotum and head, a. in dorsal view, b. in lateral view; c. body, in lateral view; d. apical part of aedeagus, in dorsal view.



Figure 9. Several galls developed by larva of *Asphondylia verbasci* (Vallot, 1827) on *Verbascum gaillardotii* Boissier, 1859.