REVISION OF THE GENUS *ODONTOTHRIPS* AMYOT & SERVILLE (*THYSANOPTERA, THRIPIDAE*) WITH THE REDESCRIPTION OF *ODONTOTHRIPS LOTI* (HALIDAY, 1852) SPECIE ON *LOTUS CORNICULATUS* CROPS

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Abstract. *Bird's – foot trefoil (Lotus corniculatus), along with alfalfa (Medicago sativa) and white clover (Trefolium repens) are some of the most important forage plants grown in Romania, but also worldwide (VÎRTEIU, 2010; YAN QI LIU ET AL., 2021). Thrips species are among the insect species that cause the most significant damage, significantly reducing the forage yield and quality. In Romania, more than 5 thrips species have been identified as Lotus corniculatus pests, of which three belong to Odontothrips genus: Odontothrips loti, Odontothrips confuses and Odontothrips phaleratus. Being one of the main pests of bird's – foot trefoil in western Romania, Odontothrips loti caused serious economic losses of up to 80% of seed yields. The biological material (thrips species) was collected from Lotus corniculatus fields located in Șagu - Arad, Romania (46°02'20"N, 21°18'05"E) during flowering seasons, in a period of 20 days, with a sample periodicity at each 48 hours. The genus Odontothrips Amyot & Serville is defined to include thrips species that presents the antenna consisting of 8 articles, article 6 being wider and having scale form; the forewings with strong hairs on longitudinal ribs; the main rib with hairy setae on almost entire surface, in the distal region presenting two hairs. Also, the measurement of body length indicated that the three species had body with length ranging from 1,532 to 2,20 ± 0,20.*

Keywords*: Thripidae, revision, Odontothrips loti, description, bird's – foot trefoil*

INTRODUCTION

The unexpected interest of Romanian farmers, in the last years, on *Lotus corniculatus* crops for seed production, has led us to investigate the *Thripidae* harmful fauna. Whereas insects of the genus *Odontothrips* Amyot & Serville are considered to be the most damaging, this encourages us to undertake a review of this genus.

Thrips species (*Thysanoptera: Thripidae: Odontothrips*) are a key group of insects with Holarctic spreading (frequently in Europe and Middle East), causing yield losses to forage crops, preferring the bird's – foot trefoil plants, making damage to the floral organs, especially to germinal careen, and determining the flowers steriliy (PITKIN, 1972; MIRAB - BOLOU ET AL., 2013).

These small insects, ranging in size from 1.3 – 2.0 mm, are represented by about 36 described species (HTTPS://THRIPS.INFO/WIKI/ODONTOTHRIPS, 2021), form an increasingly popular model group for large – scale studies, in the fields of evolutionary biology (XIE ET AL., 2010; HU ET AL., 2012; TYAGI & KUMAR, 2016; HAKIMARA & MINAEI, 2019; MASUMOTO & OKAJIMA, 2021), genetics (LI ET AL., 2020; YAN QI LIU ET AL., 2021), biodiversity (VÎRTEIU ET AL, 2016; BĂRBUCEANU ET AL., 2016) and climate change biology (BAYAR & POLGAR – BALOGH, 1999).

Although there are detailed and long – term information on *Odontothrips* species in some parts of the world, such as Europe (BOURNIER, 1983; JANEZIC, 1991, 1992, 1993; MORITZ G. ET AL, 2000, 2001; FEDOR ET AL, 2003, 2004; KOBRO, 2003), North America (BAILEY, 1949, 1957; GENTILE & BAILEY, 1968; JACOT – GUILLARMOD, 1974; ALZUGARAY, 2003; HODDLE ET AL, 2004, ANDUS

& TRDAN, 2005) or Asia (HUA L. ET AL, 2003; XIE YH ET AL., 2010; HU QL. ET AL., 2012; HAKIMARA & MINAEI, 2019; MASUMOTO & OKAJIMA, 2021), which allows their identification, there are areas that currently remain poorly represented in scientific publications. Western Romania can be considered such an example. As it is particularly diverse in term of its agroecosystems, the area remains poorly represented in the scientific literature on insects' species belonging to the genus *Odontothrips* Amyot & Serville (JENSER ET AL, 2005; BADEA ET AL, 2007 a-b; VÎRTEIU ET AL, 2010, 2011, 2016). For *Odontothrips* species it was founf that the western part of Romania is one of the most suitable in terms of climate, allowing the spread of those species to Western Europe and Republic of Moldova – Russia. Therefore, this area is an interesting one for faunistical studies in the fild of morfometry and biogeography.

In these conditions, the aim of the present paper is to provide detailed information on thrips species belonging to the *Odontothrips* genus – a review of morfological and bioecological aspects and also a short redescription of *Odontothrips loti* specie.

MATERIAL AND METHODS

This research was carried out in a *Lotus corniculatus* field located in Șagu – Arad County, Romania (46°02′20″N, 21°18′05″E) from June to September 2020. The experimental field was placed after the randomized block method, in 3 variantes and 3 repetitions, the plot sizes being: 2 m length, 1 m width, with a distance between repetitions of 4 m. For identifying the thrips adult and larval stages an filed – rearing unit consisting in an ironframe covered with insect netting fabric of white color, was designed. Caring practices such as fertilisation, weed control, were performed similarly to those applied by other growers in the region. The fields did not receive insecticide or fungicide sprays.

Thrips sampling

Thrips species attacking *Lotus corniculatus* inflorescence were sampled during two consecutive flowering seasons: from 15 June to 04 July, respectively from 23 August to 11 September 2020; for each seasons the collection of biological material was made for a period of 20 day with a collecting periodicity at every 48 hours.

Two sampling techniques were investigated: beating in tray (BACCI ET AL., 2008; MOREIRA ET AL., 2017) and direct counting. For each plot 10 plants were chosen, collecting samples from one inflorescence per plant at stages of 100% flower bud, 40% and 100% open flowers. A white plastic tray (35 x 30 x 5 cm) was used in the first sampling technique, over which five consecutive beats on the inflorescence were performed. A wooden stick with a rubber sleeve was used to beat the inflorescences. After collecting, the thrips were transferred very quickly into micro tubes containing AGA (a mixture of 10 parts of 60% ethanol with 1 part of glycerin and 1 part of acetic acid), using a moist, fine brush.

Thrips identification

In order to determine, the samples were mounted under microscope slides according to MOUND'S (2007) technique. The *Odontothrips* species were identified using morphological characteristics and taxonomic key according to the methods described by MORITZ ET AL., 2004.

The identified species were deposited in the collection of the Entomology Laboratory within Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timisoara.

RESULTS AND DISCUSSIONS

In Western Romania, during the investigated period from the *Lotus corniculatus* crop, 5 thrips species were collected, of which 3 belongs to the *Odontothrips* genus: *Odontothrips loti*,

Odontothrips confuses and *Odontothrips phaleratus*. The most important species was *Odontothrips loti* Hal, which can caused damage of up to 80% of seed production.

Genus *Odontothrips* Amyot & Servile, 1843 - Revision

Taxonomy

Class *Insecta* Linnaeus, 1758
Order *Thysanoptera* haliday, 1836
Family *Thripidae* Stephens, 1829
Subfamily *Thripinae* Kerny, 1821
Genus *Odontothrips* Amyot & Serville, 1843

Description

The body length between 1,3 – 2,2 mm. The body color – light brown to black. Antennae eight – segmented, the VI segment with a wide sense base and scale shape; the two top segments forming a style and the segment III and IV with forked sense cone. The setae on the antennae are relatively long.

Pronotum with two pairs of elongate postero – angular setae; metanotum, also, with two pair of setae located on the anterior margin, with the lateral pair shorter that the median one.

Macropterous species, the forewings with strong setae on longitudinal ribs; the main rib provided with setae almost along its entire length, in the distal region usually shaded except for a pale band near the base and provided with two setae.

Fore tibia provided with 1 – 2 claws – like of variable size, and bent in the shape of a hook. The foreleg tarsi are two – segmented and presenting 1 – 2 lateral chitinous tubercles.

Biology and ecology

All three thrips species feed on the *Fabaceae* inflorescences. The *O. loti* species is a multivoltine polyphagous species throughout southern Europe. *O confusus* is a *Medicago sativa* pest, causing losses by aborting flowers of up to 30% and decreasing by up to 50% seed production, which also occurs sporadically in the inflorescences of *Lotus corniculatus*. *O. phaleratus* is present in the grassy vegetation of meadows, from where it migrates to *Trifolium, Medicago and Lotus* crops.

Regarding female oviposition – female with the help of the ovipositor (saw-shaped) makes a cut in the epidermis of the flowers in which she lays the eggs (BOURNIER & KHOCHBAV, 1963).

Odontothrips species have two active larval stages: the first and the second stage that feed into the flowers, causing serious problems by aborting them. The mature second stage passes to the ground.

The depth at which they descend into the soil for pupation depends on the species: 25 centimeters in *O. confusus*, and in the case of *O. loti* it is a few millimeters (20 - 25). Here they build a pupal lodge from soil particles and a sticky sparse cobweb-like filamentous secretion produced by the exocrine glands in the anus.

In the soil, thrips develop through two quiescent, non-feeding pupal stages: prepupae and pupae (OBRTEL, 1963). The larvae molted after four to six hours to produce the prepupae. The prepupae molted after about three days to give rise to the pupae. The pupae stage is short-lived; it lasted between 60 - 69 hours at 50 - 90% of all individuals, at a temperature of 20°C. The adults emerge after about four days (PITKIN, 1972).

Key to *Odontothrips* species (based on PITKIN, 1972)

1 Base of sense cone on antennal segment VI small, maximum diameter less than one - third of total length of the sense cone..... 2
- Base of sense cone on antennal segment VI greatly enlarged, maximum diameter more than one - third of total length of the sense cone

2 Distal fore tarsal segment with one or two small hooks or tubercles on inner margin..... 3

3 Fore tibia with one or two stout claws at apex……. 4
- Fore tibia without stout claws, but with two small claws or one small claw and a bristle - bearing tubercle

4 Fore tibia with one stout claw. ♀ abdominal tergites II toVIII weakly striate lateral to the median setae only. Male genitalia with a single pair of stout endothecal spines supported by a well developed canaliculus 5
On *Lotus, Antbyltis, Ononis* or *Trifolium* throughout Europe and introduced into North America.....*loti* (Haliday)

5 Male genitalia with one pair of stout endothecal spines, which are supported by canaliculus..... 6

6 Sternites IV to VII of male each with a median posterior lobe. Male genitalia with a bilobed endotheca which lacks endothecal spines 7
On *Lathyrus,Vicia,* throughout Europe.....*phaleratus* (Haliday)

7 Antennal segment II dark, III pale. Male with two pairs of fairly stout endothecal spines on the genitalia, which are supported by canaliculi 8
On *Medicago* spp., *Lotus spp.* And *Eryngium,* from Germany, Hungary, Slovakia, Serbia, Rassia and Romania.....*confusus* Priesner

Odontothrips loti Haliday, 1852

Redescription: Macropterous female and male.

Coloration: Female - black body color. The legs are the same color as the body, except for the forelegs tibia which is pale; tarsi - yellow. The color of the antennal segment: I, II, V – VIII - blackish browns; III - yellow; IV - yellow, more or less dark gray or pale grayish. Dark gray forewings; only the base is pale. Males resemble females, only the antennae are lighter colored. Larvae from the first stage is light yellow except for the base of the femurs, the outer edge of the tibia, the antennae segment I and II in the middle part, the segment IV in the external basal part - which are gray. Larvae from the second stage are yellow – orange color. Prepupae - yellowish to orange, except antennae and sheaths wings that are pale, hyaline. Pupae - transparent cuticle with a pale tinge, with a pale adult visible inside; legs, wings and antennae segments slightly pale.

Structure: Female - head wider than long. Genae are slightly tough and curved. Three segments maxillary palps, the mouth cone long but not reaching the posterior edge of the prosternum. Prothorax much wider than the head and at the same time this is wider than longer (BAILEY, 1957).

The antennae segment length (μ): I= 24; II= 36 – 40; III= 60 – 68; IV= 56 – 64; V= 36 – 40; VI= 56; VII= 12; VIII= 16.

The antero – angular setae of 35 μ long; between the postero – angular setae of the pronotum, the external one 65 - 68μ and the internal of 88 - 100μ long (KNECHTEL, 1961). Setae of the IXth abdominal segment of 155 - 180 μ and the Xth segment of 140 - 156 μ.

Fore tibia on inside with a long, bent-shaped claws; on the outer side a chitinous tubercles, at the top of which is a rigid spine, 16μ long.

Males - the male resembles the female, but has on the abdominal tergites IX, in each part, a row of three rigid setae.

adult

larvae

Odontothrips loti Haliday, 1852

First – instar larvae – the antennae - 160 μ long. On postero – marginal side – the abdominal tergites VIII with a comb of microtrichia (LACASA PLASENCIA, 1996).

Second – instar larvae - the antennae segment of 200 μ length, the head of 99 μ. On the IXth abdominal tergites presents a microtrichia in a comb – shape and the segment length of 18 - 22 μ.

Prepupae - head wider than longer (123 x 74 μ), the anterior margin semicircular. Pronotum wider than longer (221 x 147 μ). On the anterior margin with a row of four long setae and also, a similar row of setae on the posterior part. On dorsal side of meso and metanotum with a group of four long, straight setae.

Pupae – the antennae segments are turned back and extend to the dorsal part of the head and pronotum, their ends being in the middle of the pronotum. Their first segment has on the anterior margin two long setae and four short ones, directed forward. Approximately in the middle of each inner margin, there is a short seate. Pronotum wider than longer (210 x 166 μ), with lateral margin rounded, strongly narrowed towards the base (OBRTEL, 1963).

Measurements (mm): Adults: body length – 1.03 – 2.20 (♀), 0.93 – 2.00 (♂); head length – 0.093 – 0.190 (♀), 0.080 – 0.187 (♂); head width – 0.131 – 0.266 (♀), 0.120 – 0.256 (♂); prothorax length – 0.138 – 0.256 (♀), 0.120 – 0.198 (♂); prothorax width – 0.167 – 0.323 (♀), 0.150 – 0.287 (♂); abdomen length – 0.710 – 1.383 (♀), 0.680 – 1.238 (♂).

Second instar larvae: body length – 0.90 – 2.10 (♀), 0.88 – 1.96 (♂); head length – 0.051 – 0.118 (♀), 0.040 – 0.115 (♂); head width – 0.085 – 0.197 (♀), 0.080 – 0.180 (♂); prothorax length – 0.100 – 0.234 (♀), 0.095 – 0.230 (♂); prothorax width – 0153 – 0.355 (♀), 0.150 – 0.350 (♂); abdomen length – 0.595 – 1.316 (♀), 0.580 – 1.310 (♂).

After our examination the adults' average values (mm) of: body length was 1.532± 0.20 mm; head length was 0,138 ± 0.020; head width was 0.193 ± 0.030; prothorax length was 0.187 ± 0.020; prothorax width was 0.236 ± 0.03; abdomen length was 0.948 ± 0.18. Firstly, as for the body size, TARBINSKII & PLAVILSCICOV (1948) recorded that the total body length is 1.1 – 1.2 mm. OBERTEL (1963), LACASA PLASENCIA & LLORÉNS CLIMENT (1996), KNECHTEL (1961) mentions the body length range from 1.3 to 1.6 mm.

With regards to the second instar larvae, our results highlight an average (mm): body length of 1.230± 0.19, head length of 0.080 ± 0.02, head width of 0.120 ± 0.02, prothorax

length and width of 1.40 ± 0.02, respectively 0.210 ± 0.03 and abdomen length of 0.770 ± 0.12. In addition, the dimensions in LACASA PLASENCIA & LLORÉNS CLIMENT's paper (1996) show that the average values of the second instar larvae body is 1.25 mm. The obtained results showed that the measured minimum and maximum dimensions are close, although they differ from those existing in the scientific literature. The average value of body length is lower than the one cited in the literature, being 1.23 mm ± 0.19 mm.

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