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SEASONAL ABUNDANCE AND HOST PREFERENCE BY *Allothrombium pulvinum* Ewing (1917) (*Acari:Trombidiidae*) LARVAE ON APHIDS (*Homoptera:Aphididae*) OF MONTENEGRO, WITH NOTES ON RATE OF PARASITISM AND NEW METRIC DATA

SUMMARY

Allothrombium pulvinum Ewing (1917) is a new addition to the fauna of Montenegro. In this paper, we report on the new metric data and seasonal abundance of *velvet mite larvae* of *Allothrombium pulvinum* Ewing in a meadow located near Lake Skadar (southern Montenegro). In early July larvae of *Allothrombium pulvinum* peaked in numbers. Host attachment sites and host preference of parasitism were investigated for this species, parasitizing a sample of 172 aphids. Larvae preferred the aphid thorax as the attachment site and most captured specimens of *Aphis* sp. were attached by one mite.

Key words: *Allothrombium pulvinum*, ectoparasitism, seasonal dynamics, attachment sites, aphids, Montenegro.

INTRODUCTION

The fauna of *trombidiid* mites has been inadequately studied in Montenegro and specifically in the area of this study. Hitherto, larvae of 12 species of the genus *Allothrombium* Berlese (1903) have been described as present in Europe. These are as follows: *A. amiraeli* Haitlinger (1997), *A. fuliginosum* Hermann (1804), *A. ignotum* Willmann (1956), *A. lechi* Haitlinger (1996), *A. monochaetum* Goldarazena et Zhang (1997), *A. monspessulanum* Robaux et Aeschlimann (1987), *A. neapolitanum* Oudemans (1910), *A. polikarpi* Haitlinger (2006), *A. pulvinum* Ewing, 1917, *A. reinholdi* Haitlinger (1994), *A. meridionale* Berlese (1910), *A. wolmari* Haitlinger (2000) (Goldarazena and Zhang 1997; Haitlinger 1994, 1996, 1997, 2000, 2006a, b; Makol 2000; Robaux and Aeschlimann 1987; Wohltmann and Makol 2009), *A. clavatum* Saboori (2010), *A. sicilianum* Haitlinger (2012). To date, only the A. clavatum Saboori (2012) has been recorded in Montenegro.

The larva of *Allothrombium* (Acari: Trombidiidae) is a large, red, univoltine mite commonly found in soil, litter and other terrestrial habitats as an important polyphagous natural enemy of many small arthropods. They are common ectoparasites of aphids (Zhang and Saboori 1996) and extract body fluids from their hosts. In the extreme, the infestations can be lethal, as has been

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shown with some nymphal and adult insects (Young and Welbourn 1987) and insect eggs (Sharma et al. 1983), but they can also be less harmful. Many parasitengonae mites gorge on insects and drop off, leaving the host seemingly unaffected (Southcott 1961; Treat 1975). However, given that mites inevitably remove essential nutrients from the host (Cheng 1973), even transient infestations should leave insects weakened or otherwise adversely affected. Their role in the natural control of aphids has now been well established, especially against *Aphis gossypii* Glover in China (e.g. Zhang et al. 1993; Dong et al. 1996; Zhang and Li 1996). Because of their impact on aphid survival and reproduction and their close association with aphids, some authors recently suggested that *Allothrombium* may have high potential as biological-control agents of aphids (Welbourn 1983; Zhang 1987, 1988a). It is a univoltine species, with a complex life cycle: non-feeding quiescent stages (prelarva, protonymph and tritonymph) alternate with active feeding stages (larva, deutonymph and adult).They are ectoparasites in their larval stage and free-living predators in their postlarval stage. *Allothrombium* deutonymphs and adults emerge in summer and autumn, respectively, and are free-living predators of aphids, spider mites and various other small arthropods. Adults may continue to moult before reproduction (Chen and Zhang 1991; Saboori and Zhang 1996). Larvae emerge in spring and are ectoparasites of aphids. *A. pulvinum* and two other well-known species, *A. fuliginosum* (Hermann) and *A. ovatum* (Zhang and Xin) have been reported from several species of aphids (Welbourn et al. 1983; Zhang 1996; Zhang and Faraji 1994; Dong et al. 1996, 1998; Dong 2001). Because the eggs of trombidiid mites hatch in early spring, larval emergence of the mite is well synchronized with the life cycle of their aphid hosts, which typically begin to migrate into fields of crops at that time (Dong et al. 1996; Zhang 1998; Zhang et al. 1999). Because the larva mites are only parasitic, they are called protelean parasites by acarologists (Treat, 1975).

MATERIAL AND METHOD

We studied *Allothrombium pulvinum* Ewing, a new species for the fauna of Montenegro, in a meadow located near Lake Skadar (southern Montenegro). We sampled the plant *Tordylium apulum* from May to August 2011. Every five days, *Tordylium apulum* were collected in the field, and, using a portable magnifying lens, parasitized aphids were detached. We stored parasitized aphids detached from the plants in small vials with 70% alcohol. In the laboratory, mite specimens were detached from their host *Aphis* sp. by an insect pin, cleared in Nessbitt's solution and mounted in Faure medium (Krantz and Walter 2009). We collected 172 aphids and 42 larvae mites. All measurements are given in micrometers (μm) and calculated using a Carl Zeiss Axioscope A1 microscope. The terminology and abbreviations are adapted from Robaux (1974) and Southcott (1986).

RESULTS AND DISCUSSION

Seasonal dynamics of *A.pulvinum* ex *Aphis* sp. (Picture 01), from the meadow located near Skadar Lake is applied in Figure 1. *A.pulvinum* was captured from the mid-May to early July. The maximum number of specimens was captured in mid-June, but maximum number of specimens recovered by larvae *A.pulvinum* was applied in early July.

Picture 01. *Allothrombium pulvinum* magnification 10x

Like in other Trombidiidae *A.pulvinum* has univoltine life cycle (Rabaux,1974; Zhang, 1998). This species probably lay eggs during March-April and larvae emerge during the spring, after 1-2 months. The occurrence of mite is highly synchronized with occurrence of aphids, their number peak is slightly earlier than those of aphids (Fig. 2).Concerning the number of mites counted on aphids, the mean number of mites load on each aphid is 1.17. Maximum 3 mites were counted on a host insect. Most captured specimens of *Aphis sp.* were attached by one mite (85.46 %), the second row is belongs to two (14.07 %), while the least number of aphids are parasitized by three mites (0.47 %).

Field studies revealed that a rates of aphid parasitism by mites increase with increasing mite abundance and aphid age. In early June the larvae of

A.pulvinum were attached to alate host 33% and 67% to apterous host (Fig.3). Dong & Wang (1993) in their studies also obtained that alatae and apterous adults have the highest rate of parasitism; preferences for these stage are positive.

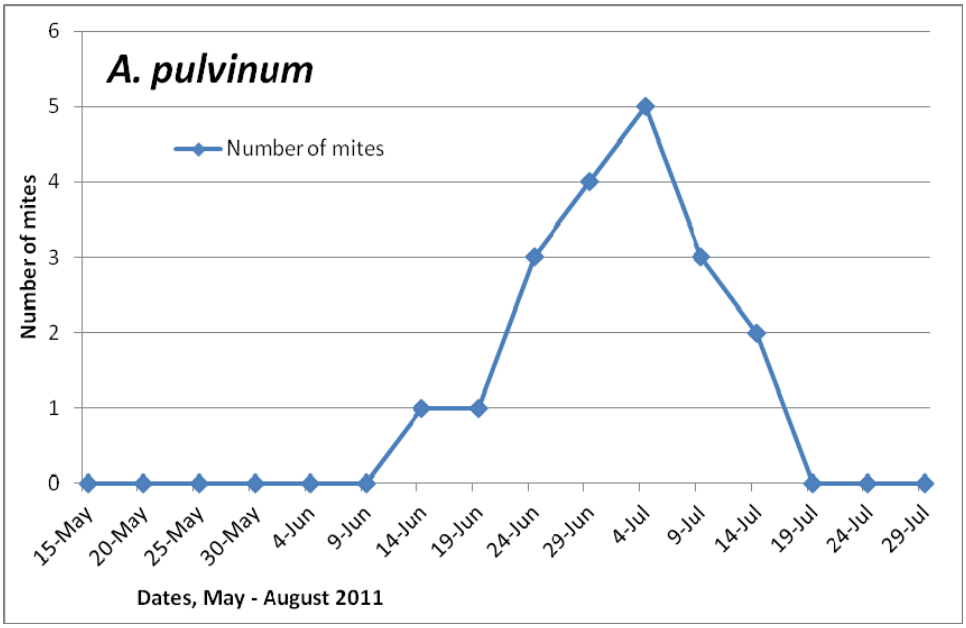

Figure 1. Seasonal abundance of *Allothrombium pulvinum* ex *Aphis* sp. in a meadow located near Skadar Lake

Mites came in contact with hosts over aphids legs, and very fast they climb on the body of hosts. The host often shook up its body and legs in defense, and sometimes the mite was thrown off. Usually mites are able to cling on the host using the claws and claw-like empodia of their legs. Than mite chose place on the body of aphid and they inserted their chelicerae into the host on the place where cuticle is soft (between body segments or between the legs and body). Once attached to a site, they usually did not move unless they are disturbed Zhang (1998). Mites are usually belayed on three hosts body domains (dorsal, lateral and ventral) on the three body segments (head, thorax and abdomen). In our study ventral surface was most preferred by mites - 75% of the occurrence observed, whereas the dorsal surface was preferred in 25%. Most of the larvae *A.pulvinum* were attached on the thorax of the host, 72,4% (Fig.4). The second common most attachment site was the abdomen 24,3%, and only 3,3 % of the mites was attached to the head.

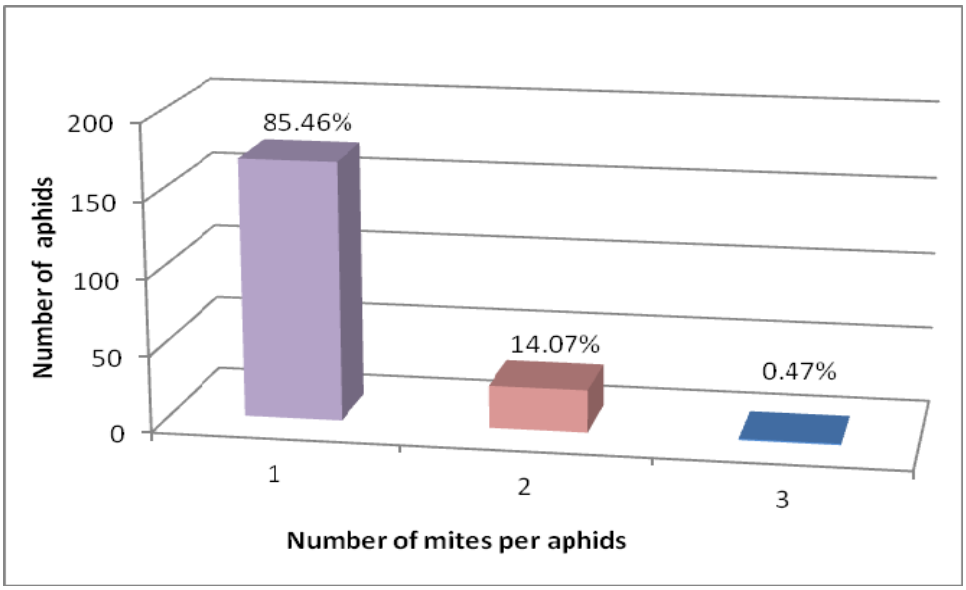

Figure 2. Number and density of mites per aphid host.

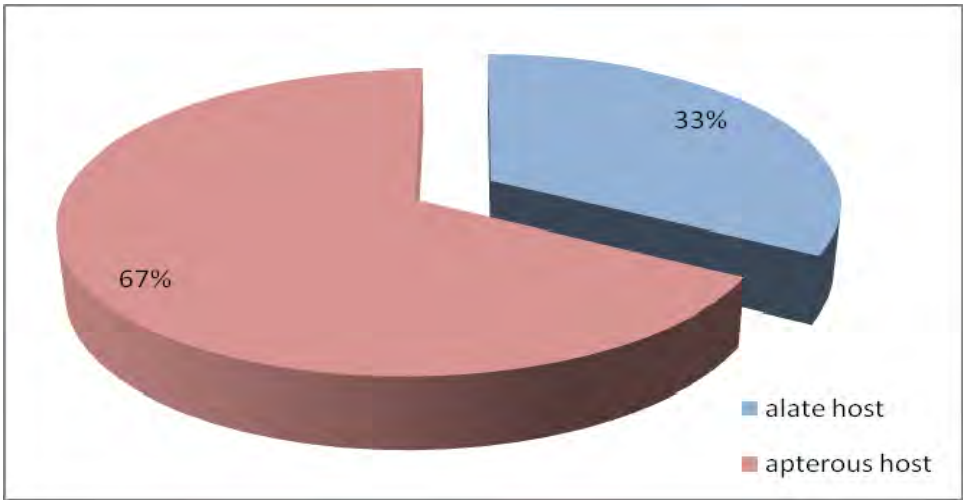

Figure 3. The ratio of total larvae attached to alatea host and apterous host

Given the small size of the thorax in comparison with the abdomen, the thorax was preferentially parasitized whereas the abdomen was avoided. This is most likely because aphid hosts are able to defend themselves by pushing away intruding mites using their legs. The legs could reach their head and abdomen but could not push away mites from the thorax. This can be reason why the thorax became a most preferable site for mites to attach host successfully. Zhang (1991) have got similar results with previous reports.

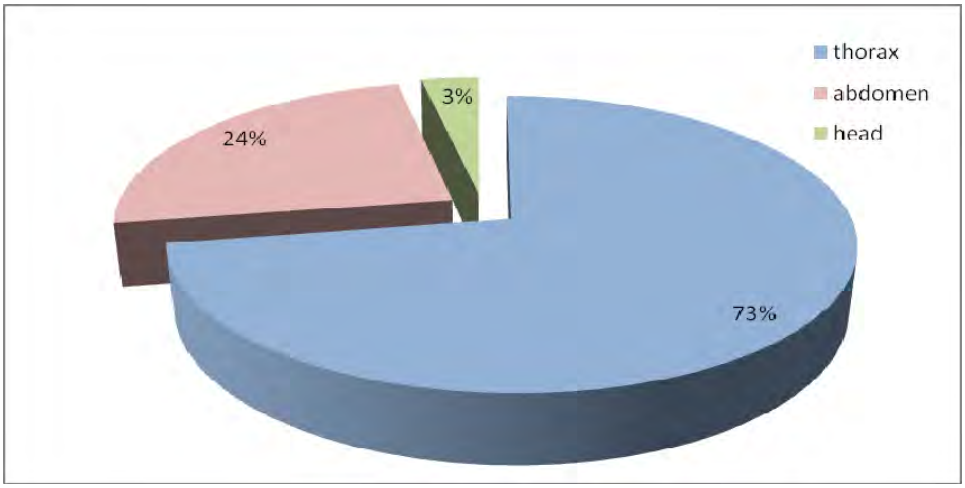

Figure 4. The ratio of attachment sites of *Allothrombium pulvinum* on *Aphis* sp.

For the integrated pest menagement strategies determination of the seasonal abundance of the natural enemies of aphids especially on the herbaceous plants is very important. Mites relationship host-parasitic and their biology are still poorly known in Montenegro and regarding that should be investigated in the further studies.

Table 1. Metric data in micrometers (μm) of the podorsal sclerites and legs of *Allothrombium pulvinum* larvae from Montenegro in comparison with data from Spain (Tirapu), Iran (Sari) and China (Shangai). Data are means (range) for N=15.

	Spain	Iran	China	Montenegro
AA	57.2(54-69.4)	61(56-65)	56(45-88)	58(53-70)
AW	85.3(75-86.3)	81(75-88)	80(128-81)	83(73-81)
PW	88.6(72.3 - 105)	91(83-100)	81(30-85)	84(70-98)
SB	58.1(50.6 - 60)	53(50-57)	51(40-55)	61(52-57)
ABS	75.8(60 - 93.8)	87(82-93)	84(59-88)	73(66-85)
PSB	45.9(41.3 - 67.5)	51(40-60)	49(75-48)	44(41-62)
SD	102.2(97.5 - 146.3)	138(123-150)	133(62-139)	104(99-133)
AP	31.9(30-39.4)	35(30-40)	33(30-35)	33(30-41)
AM	46.9(43.1 - 65.6)	49(38-55)	45(40-50)	44(42-66)
AL	62.8(50.6 - 67.5)	61(50-78)	63(59-70)	60(55-66)
PL	75(69.4-789.8)	73(68-78)	76(75-78)	73(68-77)

S	62.8(56.3 - 67.5)	67(58-88)	67(62-70)	60(55-64)
MA	34.7(29.8 - 48.8)	45(43-47)	51(48-54)	35(30-45)
W	-	112(103-119)	112(-115)	110(101-111)
HS	40.4(32 - 48.8)	40(35-45)	47(45-48)	38(30-41)
LSS	85.3(60 - 97.5)	76(63-91)	88(76-98)	81(69-93)
SL	66.6(65.6 - 77.3)	69(53-78)	73(68-83)	63(61-73)
SS	40.3(31.9 - 45)	38(35-43)	37(30-43)	38(30-39)
Ip	1244.2(1202.7 - 1296.2)	1316(1255-1365)	1234 (1178-1269)	1212(1198-1283)
Leg I	406.7(387.4 - 446.3)	437(416-460)	409(389-419)	398(385-428)
Cx I	73.1(69.4 - 90)	75(70-80)	77(75-78)	71(68-81)
Tr I	46.9(43.1 - 50.6)	52(50-53)	48(45-50)	44(41-48)
Fe I	75.3(73 - 93.8)	83(78-88)	78(70-83)	72(70-88)
Ge I	44.1(39.4 - 52.5)	51(48-53)	44(40-46)	45(39-48)
Ti I	70.3(65.6 - 84.4)	81(78-87)	70(63-75)	68(64-85)
Ta I	97(80.1 - 103.1)	92(85-97)	93(88-98)	93(83-101)
Leg II	407.2(388.2 - 414.2)	414(403-431)	397(377-410)	403(386-402)
Cx II	79.7(76.9 - 84.4)	83(78-88)	84(83-85)	77(74-80)
Tr II	46.8(39.4 - 50.6)	50(50-50)	47(40-50)	43(39-48)
Fe II	81.6(61.9 - 82.5)	76(73-78)	71(59-75)	78(66-81)
Ge II	38.4(33.8 - 46.9)	43(40-48)	40(33-45)	38(32-44)
Ti II	76.9(65.6 - 76.9)	77(75-82)	67(60-73)	77(64-80)
Ta II	83.9(75.9 - 97.5)	87(83-90)	88(83-90)	80(75-98)
Leg III	430(424.6 - 452.3)	464(436-486)	425(412-440)	432(420-448)
Cx III	75.9(71.3 - 78.8)	78(75-83)	76(75-78)	77(73-80)
Tr III	57.2(50.6-71.3)	62(55-67)	55(53-58)	55(49-67)
Fe III	72.2(65.6-82.5)	76(73-78)	72(65-80)	72(66-80)
Ge III	42.7(39.4-52.5)	50(45-55)	43(39-45)	44(40-49)
Ti III	84.4(75-95.6)	96(88-105)	83(78-88)	81(77-93)
Ta III	98(93.-106.9)	102(95-110)	96(93-100)	97(92-102)

Allothrombium pulvinum from Montenegro, Spain, Iran and China have similar measurements and the ranges of metric data overlap. Geographical variation within the species explain the minor differences in the morphological characters among population from the four localities. Based on the presence *A.pulvinum* on the four distant localities indicates that this species has a vary wide distribution.

CONCLUSION

- *Allothrombium pulvinum* Ewing (1917) is new record for fauna of Montenegro.

- Host attachment sites and host preference of parasitism were investigated for this species parasitizing a sample of 172 aphids, and 42 larvae mites.

- The maximum number of specimens was captured in mid-June, but maximum number of specimens recovered by larvae *A.pulvinum* was applied in early July.

- The mean number of mites load on each aphid is 1.17,and maximum 3 mites were counted on a host insect.

- Most captured specimens of *Aphis sp.* were attached by one mite (85.46 %), the second row is belongs to two (14.07 %), while the least number of aphids are parasitized by three mites (0.47 %).

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SEZONSKA ABUNDANCA I PREFERIRANJE DOMAĆINA OD STRANE *Allothrombium pulvinum* Ewing (1917) (Acari:Trombidiidae) LARVI NA AFIDAMA (Homoptera:Aphididae) U CRNOJ GORI, SA PRILOGOM STOPE PARAZITIZMA I NOVIM METRIČKIM PODACIMA

Allothrombium pulvinum Ewing je nova vrsta za faunu Crne Gore. U ovom radu su objavljeni novi metrički podaci i sezonska abundanca larvi grinja *A. pulvinum* Ewing sa livade koja se nalazi u blizini Skadarskog jezera (južni dio Crne Gore). S početka jula larve *A. pulvinum* dostižu najveću brojnost. Istraživana su mjesta kačenja i prioriteti parazitizma na domaćinu na uzorku od 172 vaši. Larve preferiraju toraks afida kao mjesto kačenja, a najveći broj sakupljenih *Aphis sp.* bio je sa po jednom zakačenom grinjom.

Ključne riječi: *Allothrombium pulvinum*, ektoparazitizam, sezonska dinamika, mjesta kačenja, afide,Crna Gora.