Project Update: December 2016

We succesfully determined all material that was collected from our locations during July-August 2016. The estimated parasitism rate from all sampling sites was around 40%. In some samples, the mummies developed, but the parasitoids had died before they had a chance to emerge. Samples from Tara and Stara Planina mountains had the highest parasitism rate and number of different species. Suva Planina, our fourth sampling location, probably due to specific arid conditions (as mentioned in our previous project update), had very low percentage of aphid infestation, and thus also parasitism. The total number of parasitoid samples was 91, with 33 species that belong to 10 different genera (*Adialytus*, *Aphidius*, *Binodoxys*, *Ephedrus*, *Lipolexis*, *Lysiphlebus*, *Monoctonus*, *Pauesia*, *Praon* and *Trioxys*). As expected, most common genus was *Lysiphlebus*, with the dominant species from *Lysiphlebus fabarum group*. The number of specimens per sample varied between one and more than a 100 individuals. The recorded different tritrophic parasitoid-aphid-plant associations (total of 87) are presented in the table at the end.

We created database with geographical coordinates and described habitat and the vegetation type of the sampling sites. Also, we compared our findings with the previous data, and recorded numerous species and several genera on locations that were not reported in earlier years. For Suva planina that is genus *Lipolexis* (*species Lipolexis gracilis*). For Stara planina those are: genus *Binodoxys (Binodoxys angelicae* and *Binodoxys sp.*), genus *Lipolexis* (*Lipolexis gracilis*), genus *Adialytus* (*Adialytus salicaphis*), genus *Trioxys* (*Trioxys sp.*) and species *Lysiphlebus testaceipes* and *Praon abjectum*. From Kopaonik we recorded genera *Binodoxys* (*Binodoxys sp.*) and *Trioxys* (*Trioxys betulae*), and also Pauesia *pini* and *Lysiphlebus hirticornis* species. From Golija, genera *Praon* (*Praon abjectum*), *Ephedrus* (*Ephedrus plagiator*), *Pauesia* (*Pauesia cupressobii*), *Adialytus* (*Adialytus ambiguus*), *Binodoxys* (*Binodoxys acalephae*) are for the first time detected. And finally, for mountain Tara, we recorded *Pauesia* (*Pauesia sp.*), *Adialytus* (*Adialytus salicaphis*) and *Binodoxys* (*Binodoxys angelicae*) genera.

For the first time in Serbia in mountain habitat, we found invasive and extremely competitive *Lysiphlebus testaceipes*, species native to South America that was introduced to Europe as biological control agent. Because of its invasive nature, it was removed from the list of positive biological control agents (Stankovic et al., 2015). In the paper of Stankovic et al. (2015), authors for the first time report occurrence of this species in Serbia, on two localities, city of Nis and Lebane, that are located in the valley, around 150 km from our location. However, this is the first finding of *L. testaceipes* for Serbia in high altitudes, which indicates that this species is rapidly spreading and adjusting to habitats with cooler climate.

Furthermore, we collected samples from both, disturbed areas and locations that are not under the human impact, so that we could compare composition and frequency of plant-aphid-parasitoid species, and evaluate the level of human influence. In sampling sites where human influence was significant (residential area, skiing resorts, high frequency traffic, pastures) the plant composition was more uniform, with some common, ruderal plant species, while undisturbed locations had greater diversity of plant species, that cannot be found in urban

areas. Thus, rare and specialised tritrophic interactions of plant-aphid-parasitoid species is less likely to be found in sites that are disturbed due to human activity.

Sites that are significantly under human influence are on mountains Tara and Kopaonik. The biggest threat for the vegetation and insect communities are deforestation and pollution due to growth of residential and touristic locations.

Golija, Stara and especially Suva mountains are locations attractive for hikers and are less urban than Kopaonik and Tara, with smaller number of touristic locations. Plan for mountain Golija to become important tourist location, with ski resort and other kinds of entertainment is, at least for now, abandoned. For these three mountains, the biggest threat to parasitoids and their aphid-plant interactions are deforestation and large pastures affected by overgrazing.

We held several meetings with park rangers, residents, farmers and tourist managers about unique plant-aphid-parasitoid interactions. People were generally very interested and didn`t have any knowledge about these interactions and benefits of parasitoids, but wanted to help and participate in conservation of these unique insects. We also talked about the importance of rare endemic plants that grow only on these mountains. We proposed to them to leave the patches of land in disturbed areas, where possible, so that native plants could grow. The majority of farmers and rangers agreed with our suggestion.

Parasitoids sampled and determined during our project (from left to right, top to bottom): *Praon abjectum* together with *Binodoxys angelicae*, *Monoctonus crepidis*,*Ephedrus niger*, *Pauesia pini*¸*Adialytus ambiguus*, *Lysiphlebus hirticornis*

Recorded parasitoid-aphid-plant associations (total of 87) are given bellow.

Parasitoid	**Aphid host**	**Plant**
Aphidius matricariae	*Dysaphis sp.*	*Malus sp.*
Adialytus ambiguus	*Sipha sp.*	*Arrhenatherum elatius*
Adialytus salicaphis	*Cavariella theobaldi + Cavariella aegopodii*	*Salix alba*
	Chaitophorus capreae	*Salix caprea*
	No host data	*Salix caprea*
Aphidius avenae	*Sitobion avenae*	*Dactylis glomerata*
Aphidius ervi	*Rhopalosiphum sp.*	*Hordeum murinum*
	No host data	*Sambucus nigra*
Aphidius funebris	*Uroleucon sp.*	*Cichorium inthybus*
	Uroleucon sp.	*Cirsium sp.*
Aphidius matricariae	*Brachycaudus helichrysi*	*Matricaria sp.*
Aphidius phalangomyzi	*Macrosiphoniella sp.*	*Artemisia sp.*
Aphidius rosae	*Macrosiphum rosae*	*Rosa sp.*
Aphidius salicis	*Cavariella theobaldi + Cavariella aegopodii*	*Salix alba*
Aphidius urticae	*Microlophium sp.*	*Urtica dioica*
Aphidius sp	*Macrosiphum sp.*	*Euphorbia amygdaloides*
Aphidius sp.	*Metopeurum fuscoviridae*	*Tanacetum vulgare*
Aphidius sp.	*Uroleucon sp.*	*Cirsium sp.*
Binodoxys heraclei	*Aphis sp.*	*Galium aparine*
Binodoxys acalepahe	*Aphis sp.*	*Urtica dioica*
Binodoxys acalephae	*Aphis sp.*	*Epilobium hirsutum*
Binodoxys angelicae	*Aphis fabae*	*Chenopodium album*
	Aphis sp.	*Galium aparine*
	Aphis sp.	*Solanum nigrum*
	Brachycaudus cardui + Aphis sp.	*Rumex acetosa*
	Brachycaudus helichrysi	*Matricaria sp.*

	Brachycaudus cardui	*Rumex obtusifolius*
	Lipaphis erysimi	*Capsella bursa pastoris*
	Microlophium sp.	*Urtica dioica*
	Uroleucon sp.	*Cirsium sp.*
Binodoxys sp.	*Aphis urticata*	*Urtica dioica*
Binodoxys sp.	*Aphis sp.*	*Epilobium montanum*
Binodoxys sp.	*Cavariella theobaldi + Cavariella aegopodii*	*Salix alba*
Binodoxys sp.	*Macrosiphum rosae*	*Rosa sp.*
Ephedrus niger	*Uroleucon sp.*	*Cirsium sp.*
Ephedrus plagiator	*Macrosiphum rosae*	*Rosa sp.*
Lipolexis gracilis	*Aphis affinis*	*Mentha longifolia*
	Aphis sp.	*Carduus acanthoidees*
	Aphis sp.	*Galium aparine*
	Aphis sp.	*Galium sp.*
	Aphis farinosa	*Salix purpurea*
	Aphis sp.	*Solanum nigrum*
	Aphis sp.	*Rumex acetosa*
	Aphis sp.	*Cirsium arvense*
	Aphis sp.	*Cirsium arvense*
	Brachycaudus cardui	*Rumex obtusifolius*
	Myzus cerasi	*Prunus cerasifera*
Lysiphlebus cardui	*Aphis sp.*	*Tragopogon pratense*
	Aphis sp.	*Urtica dioica*
	Uroleucon sp.	*Cirsium sp.*
Lysiphlebus fabarum	*Aphis fabae*	*Erigeron canadensis*
	Aphis fabae	*Tanacetum parthenium*
	Aphis fabae + Uroleucon sp.	*Cichorium intybus*
	Aphis rubi	*Rubus fruticosus*

	Aphis ruborum	*Rubus fruticosus*
	Aphis umbrella	*Malva sylvestris*
	Aphis urticata	*Urtica dioica*
	Aphis sp.	*Sedum ochroleucum*
	Aphis sp.	*Galium sp.*
	Aphis sp.	*Zea mays*
	Aphis sp.	*Carduus acanthoidees*
	Aphis sp.	*Rumex obtusifolius*
	Aphis sp.	*Galium aparine*
	Aphis sp.	*Cichorium intybus*
	Aphis sp.	*Cirsuim candelabrum*
	Aphis sp.	*Cirsium sp.*
	Brachycaudus cardui	*Cirsium eriophorum*
	Microlophium sp.	*Urtica dioica*
	Uroleucon sp.	*Cichorium inthybus*
Lysiphlebus hirticornis	*Metopeurum fuscoviridae*	*Tanacetum vulgare*
Lysiphlebus testaceipes	*Aphis sp.*	*Solanum nigrum*
Monoctonus crepidis	*Nasonovia sp.*	*Hieracium pilosella*
Pauesia cupressobiii	*Cinara juniperi*	*Juniperus communis*
Pauesia pini	*No host data*	*Pinus sylvestris*
Pauesia sp.	*Cinara sp.*	*Pinus nigra*
Praon abjectum	*Aphis sp.*	*Solanum nigrum*
	Aphis sp.	*Epilobium hirsutum*
Praon rosaecola	*Macrosiphum rosae*	*Rosa sp.*
Praon volucre	*Aphis craccivora*	*Melilotus albus*
	Hyperomyzus lactucae	*Sonchus oleraceus*
	Uroleucon sonchi	*Sonchus asper*
Praon yomenae	*Uroleucon sp.*	*Cirsium sp.*

	Uroleucon cichorii	*Cichorium inthybus*
Trioxys betulae	*Symydobius oblongus*	*Betula pendula*
Trioxys pallidus	*No host data*	*Corylus avellana*
Trioxys betulae	*Hyadaphis sp.*	*Betula pendula*
Trioxys sp.	No host data	*Galium sylvaticum*