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STUDY SITES INFLUENCED BY NATURAL AND HUMAN IMPACTS IN TANAP AND THEIR ACAROFAUNA

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Abstract: Soil mites were studied in Vysoké Tatry Mountains over the period 2007 – 2010, sampled in Norway spruce stands affected by the wind, forestry practices and/or the forest fire, and also in unafected site. Species spectrum, diversity, density of mites in study sites were studied and compared. Greatest differences in species diversity over time were documented in the forest affected by the timber removal and/or forest fire, lowest differences were documented in the forest not affected by the wind.

Key words: acarofauna, mites, habitat, TANAP

INTRODUCTION

The information on restoration processes and succession of soil invertebrates after various destructive impacts on forest ecosystems comes mainly from areas with a higher risks of natural or anthropogenous disturbances. The fauna and succession of soil mites in spruce forests of North America were studied by HEINSELMAN (1981). ZACKRISSON (1977) evaluated community stability of mesofauna of soil invertebrates in burned boreal forest ecosystem in Norther Europe. On the other side, substantially less information exists on the influence of wind disturbances on forest ecosystems and their soil macrofauna (CANGAM & LOUCKS 1984). Further data are available e.g. in the papers of CONNEL & SLATYER (1977) and also DMITRIENKO (1985), these authors studied the changes in environment using various indicators and evaluated the stability of invertebrate communities in forest ecosystems. Papers bringing the information on soil mites without any data on species spectrum appear only marginally. Mostly, during the observation of abundance of other groups of soil fauna, if appear, the most frequently in connection with area restoration after destructive impacts of various environmental factors. However, more detailed papers exist on pincers (Oribatida) and on their community structure focussed on evaluation of succession processes in forest communities (HUBERT 1999). From mountain spruce forests in High Tatra Mts. prepoderantly faunistic papers are available dealing with some families of soil mites, however, regardless of habitat types and also influence of natural disturbances (DANIEL 1974, HALAŠKOVÁ 1974, KUNST 1974, MRCIAK 1974, MAŠÁN 2001). During the last years soil mites have been studied there more intensively in various types of habitats impacted by natural and human factors (KALÚZ & FERENČÍK 2009).

DATA AND METHODS

A great changes came to origin in spruce forest in High Tatra Mountains affected by the wind in November 2004 and consequent impacts of forestry practices (felling and timber removal) and/or forest fire. The research widely focussed on faunistics, species spectrum, habitat preferences and community structure of soil mites run in TANAP during the years 2007-2010. Four study sites were explored:

NEX – Tatranská Lomnica-Jamy (49°09'47"N, 20°15'56"E) – wind-modified forest where timber has been left unsalvaged

EXT – Nová Polianka-Danielov dom (49°07'96"N, 20°09'47"E) – wind-modified forest where timber has been salvaged

FIR – Tatranské Zruby-Zhorenisko (49°08'12"N, 20°11'59"E) – wind-modified forest with salvaged timber with the editional effect of forest fire

REF – Vyšné Hágy-Smrekovec (49°07'19"N, 20°06'19"E) – (reference site) – not affected forest

Štart – (49°10'36"N, 20°5'13"E) not affected in year 2007 - forest destroyed in 2008, the mites from this locality are included in Table 1. only, not in figures and habitats stated in the text

Soil samples of standard volume (10x10x5cm – the year 2007; 4x5x10 cm – 2008-2010) were taken from study sites from May to September (10 samples in each site during each field work). Samples were taken from soil with bare surface, spruce litter, moss, grass, *Calamagrostis villosa* (Chaix) J. F. Gmelin, fireweed – *Chamerion angustifolium* (L.) Holub, *Vaccinium myrtillus* L. and *Calluna vulgaris* (L.) Hull. Mites were isolated in Tullgren photoeclectors, preserved in 70% ethylalcohol and mounted into permanent slides using Liquido de Swann, then were identified microscopically. This paper is focussed mainly on mite species afinity to occur in various habitats, to comparison of their taxocenoses, and concludes the whole research period. Species spectrum of mites is presented in Table 1. in this paper and some other information on mite species of study area already appeared in the paper of KALÚZ (2011).

RESULTS AND DISCUSSION

The influence of wind, fire and human management in study area created the spots of soil with bare surface. A few mites occurred in this type of habitat. The individuals of ecologically adapted and widely distributed microphytophagous *Cocceupodes molicellus* (C.L. Koch, 1838) dominated. Less abundant were predaceous mesoedaphic mites *Robustocheles (Proc.) mucronata* (Willmann, 1936) and epigeic *Eustigmaeus segnis* (Koch, 1836). Other mites with low abundance there, *Cyta latirostris* (Hermann, 1804) and *Armascirus taurus* (Kramer, 1881), belong to epigeic prostigmatic representatives chasing on small invertebrates in low vegetation and/or sucking their eggs. Small edaphic *Rhodacarellus silesiacus* Willmann, 1936, mostly known from meadows and similar plant habitats, represented the mesostigmatic mites. Very movable and more abundant epigeic predator *Hypoaspis (Pneum.) lubricoides* Karg, 1971 occurred there together with more scarce *Pachylaelaps littoralis* Halbert, 1915, requiring similar environmental conditions. Also the forest species *Asca bicornis* (Canestrini et Fanzago, 1887) was found there. We can suppose that these species penetrate to soil without vegetation from neighbouring habitats with vegetation, where they have better food and shelter conditions. They are movable, their activity do not exclude the occurrence in bare soil, where they can sometimes find an available food in soil microcaverns.

After the impacts a suitable conditions originated for the pioneer vegetation in damaged sites, mainly for *Ch. angustifolium.* In its continuous growths nearly an absence of other plants was visible and the soil surface was mineralized. Like in a bare soil, in the growth of *Ch. angustifolium* a small mite *C. molicellus* prevailed, together with related microphytophagous *Linopodes motatorius* Linnaeus 1758. Small predator *Coccorhagidia clavifrons* (C. L. Koch, 1838) belongs to mesoedaphic and rare *Shibaia longisensilla* (Shiba, 1969) to edaphic representatives of the family Rhagidiidae. One of the smallest mites, euryoecous and mycetophagous *Pediculaster mesembrinae* (R. Canestrini, 1881) occurred only solely there. Small epigeic prostigmatic predator *Cunaxoides biscutum* (Nesbitt, 1936) occurring there is known chasing on vegetation and soil surface, while mesostigmatic epigeic and movable predators *Hypoaspis (Pneum.) lubricoides* Karg, 1971*, Antennoseius dungeri* Karg, 1965 are larger. Other predators *Leptogamasus (Val.) oxalis* (Karg, 1968), *Leptogamasus (Val.) sinuforceps* (Athias-Henriot, 1967) and *Pergamasus barbarus* Berlese, 1906 belong to big mites. In this plant habitat we found also prostigmatic forest mite *Nicoletiella denticulatum* (Schrank, 1776) and mesostigmatic species, silvicolous *Zercon montigenus* Blaszak, 1972. The representation of mites (Fig. 1) included mostly current and sporadic species, rare species appeared in fireweed growths of EXT site only.

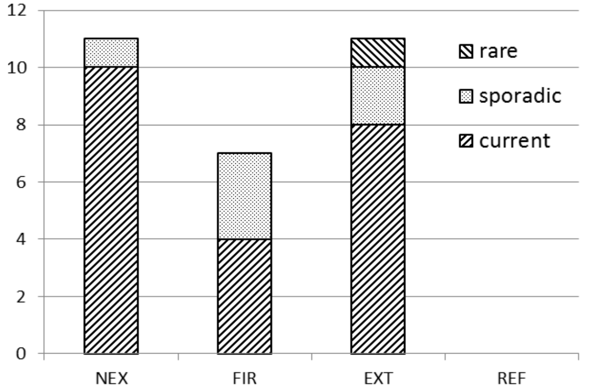

Fig. 1. Numbers of mite species in fireweed habitats

In the forest habitat with timber not salvaged (NEX) the plant *Chamerion angustifolium* created smaller or larger spots of growth spread in other vegetation. This habitat with richer plant composition showed also a richer mite taxocoenoses compared with those in a continuous growth of *Ch. angustifolium*. Besides other mites, predaceous a relatively current mesostigmatic *Pseudoparasitus (Olol.) venetus* (Berlese, 1903), *Pachylaelaps karawaiewi* Berlese, 1921 and *Veigaia nemorensis* (C. L. Koch, 1839) were there, often occurring together with a typical forest species *Trachytes aegrota* (C. L. Koch,

1841) and *Zercon carpathicus* Sellnick, 1958, the last mentioned one is considered a thermophilous and semi-xerotolerant species. The habitat less suffered from impacts compared to other study sites (EXT, FIR) and this fact was confirmed by higher share of epigeic and more movable meadow mites.

The fire destroyed the most of vegetation including the growth of moss (*Sphagnum* sp.). The small remaining and isolated spots of *Sphagnum* sp. disapeared (the influence of sun and drying) during the years 2008-2010. But, we succeeded to study the poor mite spectrum in *Sphagnum* sp. before its disapearing. Small *C. molicellus* prevailed there with very tiny *Tarsonemus virgineus* Suski, 1969. The predaceous family Rhagidiidae was represented by very frequent *C. clavifrons*, current and widely distributed meadow species *Poecilophysis (D.) pratensis* (C. L. Koch, 1835), and rare species *Poecilophysis* (*Dentocheles*) *wankeli* Zacharda, 1980. We found out there also the prostigmatic predators *Bdella iconica* Berlese, 1923 and *C. biscutum*. Besides the forest species *N. denticulatum* the smaller predaceous mesostigmatic mites *Arctoseius cetratus* (Sellnick, 1940) and *Blattisocius keegani* Fox, 1947 were also present.

The highest number of mites appeared in moss growths of FIR site (Fig. 2), other sites showed substantialy lower species numbers represented mostly by current smites, less by sporadic ones, except for NEX.

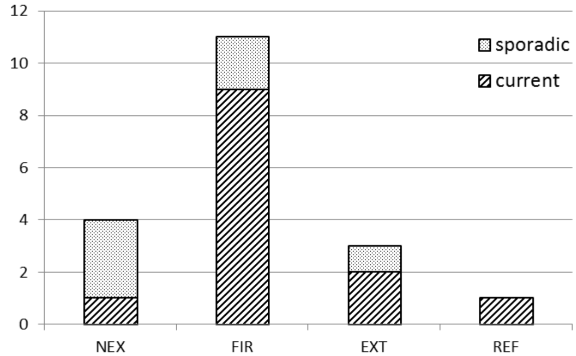

Fig. 2. Numbers of mite species in moss habitats

Low species richness characterized also the rhizosphere of bilberries (*Vaccinium myrtillus*) in unafected litter (REF). On the other side, in bilberry rhizosphere at the sites with timber salvaged, possibly also damaged by fire, more mite species appeared (Fig. 3). In their taxocoenoses slightly prevailed the meadow mites. They probably penetrated into the rhizosphere of bilberries from neighbouring growths of grasses and meadow plants.

The highest numbers of species appeared at EXT and FIR sites, less at NEX, created by current and sporadic species. Rare species were registerd at FIR site, while at REF site only current species occured.

Mainly meadow mites prevailed in a typical grassy habitats. The rhizosphere of *C. villosa* besides current prostigmatic mites *C. molicellus*, *L. motatorius* and *P. pratensis* included more typically meadow species, among which a wide distributed endeostigmatic *Pachygnathus elongatus* Duges, 1834 and more scarce *Pachygnathus villosus* Duges, 1834 occurred. Very tiny Tarsonemima were represented by *T. virgineus*, *Bakerdania quadrata* Ewing, 1939 and *Imparipes puberulus* Sevastyanov, 1974, while *Bakerdania gracilis* (Krczal, 1958) belonged to rare ones. Prostigmatic predators of the families Stigmaeidae, Bdellidae and Cunaxidae included the species

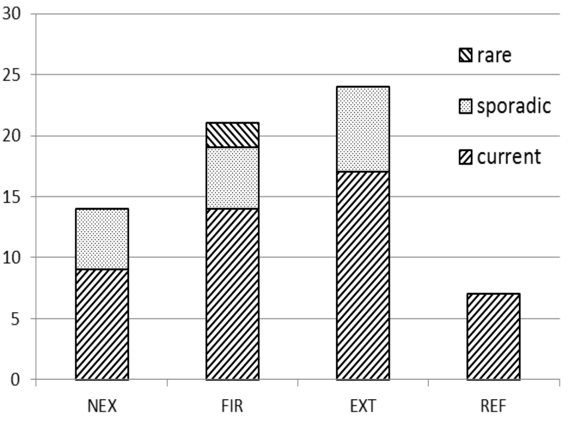

Fig. 3. Numbers of mite species in bilberry habitats

Eustigmaeus segnis, *E. pectinata* Ewing, 1917, *Bdella iconica* Berlese, 1923 and *C. setirostris,* respectively.

Among mites the tiny species *Rhodacarellus silesiacus* Willmann, 1936 and *Hypoaspis nolli* Karg, 1962 were found, while epigeic meadow *Hypoaspis angusta* Karg, 1965, *H.* (*Pneumolaelaps*) *lubricoides*, *Hypoaspis forcipata* Willmann, 1955 and scarce species *Antennoseius dungeri* Karg, 1965 belonged to bigger ones. Large and movable mainly meadow predators *Pergamasus mediocris* Berlese, 1904, *Leptogamasus (Val.) sinuforceps* (Athias-Henriot, 1967) and *Geholaspis pauperior* (Berlese, 1918) also occurred there together with euryvalent predators *V. nemorensis*, *H. aculeifer* and *P.* (*O.*) *placentulus*. Noticeably, these grassy habitats were inhabited also by the species previously considered a typically forest species e.g. *Gamasellus montanus* (Willmann, 1936), *Eviphis ostrinus* Koch, 1836, *Pachylaelaps magnus* Halbert, 1915, *Pergamasus barbarus* Berlese, 1906 and euryzonal, ecologically tolerant *Zercon carpathicus* Sellnick, 1958. Solely, in grassy rhisosphere the only forest representant of astigmatic mites - *Tyrophagus mixtus* Volgin, 1948 was registered. Grassy habitats showed the highest numbers of species (Fig. 4) compared to other habitats, balonging mainly to current and sporadic species. Rhiozosphera of grass included the highest numbers of species at FIR and EXT, less at NEX and REF. Rare species were present at EXT and REF sites only.

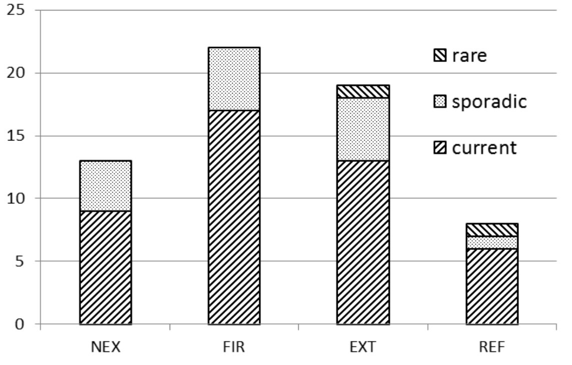

Fig. 4. Numbers of mite species in grassy habitats (*C. villosa*)

At the study sites EXT and FIR frequently occurred also the spots of other low plants. In unafected forest more extensive growths of various plants occurred, but they created another type of mosaics. Richer taxocenoses of soil mites there were found out in plant habitats (Fig. 5). The highest number of species appeared in REF site, where the plant growths created a small clearings. A few mite species occurred in plant habitats of damaged sites (EXT, FIR and NEX) compared to those of unafected forest. All groups of mites were occurring at REF and FIR, while current species were found at EXT only.

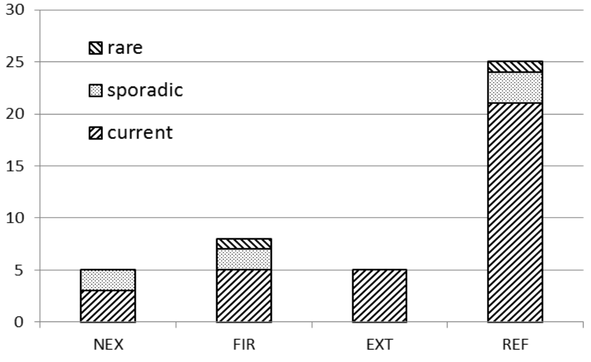

Fig. 5. Numbers of mite species in plant habitats

Mite species composition in plant habitats corresponded with those of grassy habitats, but, it was more variegated. On this fact mainly the presence of prostigmatic predators and thermophilous mites *Storchia robustus* (Berlese, 1885), *Bdellodes* (*Hoploscirus*) *meridionalis* (Thor, 1931) together with ecologically adapted *B. iconica* and *C. latirostris* participated. Another predators, small mesostigmatic *Amblyseius wainsteini* Gomelauri, 1968, *Amblyseius obtusus* (C. L. Koch, 1839) epigeic *A. cetratus*, *A. bicornis* and larger *P.* (*O.*) *venetus* are known chasing small invertebrates on vegetation and on soil surface, respectively. Less representatives of large forest predaceous mites of the family Parasitidae inhabited the plant rhizosphere - *Leptogamasus (Val.) cuneoliger* (Athias-Henriot, 1967) and *Holoparasitus calcaratus* (C. L. Koch, 1839). Among typical forest species we can include prostigmatic species *N. denticulatum* and mesostigmatic mite *Celaenopsis badius* C. L. Koch, 1836. Very interesting and important finding was done there – the occurrence of larvae of parasitic mites *Neotrombicula inopinata* (Oudemans, 1909) regularly parasitizing small mammals, however, with a possible risk of parasitism on humans.

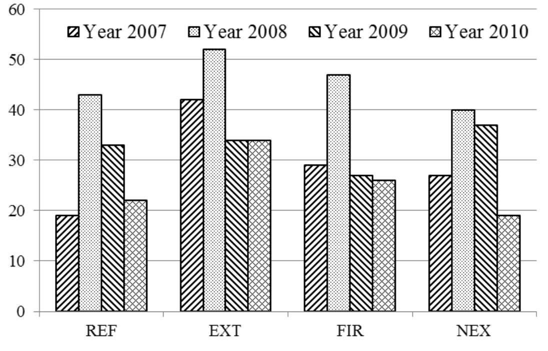

Fig. 6. Numbers of mite species at study sites during the research period

Number of mite species varied during the research period (Fig. 6). The highest values appeared on all study sites in 2008 and then slowly decreased during the next two years, the lowest values in 2010 were shown on NEX and REF sites.

Species diversity in the year 2007 was very low in all study sites, the REF showed the highest diversity among them (Fig. 7). The values of diversity increased during the next three years and varied about the value H' = 2.5, on damaged sites with a tendence rather to decrease.

The highest species diversity in mite taxocoenoses was find out in undamaged forest, particularly in habitats created by low vegetation (grassy growths, bilberries and moss). Spruce litter without vegetation was an exeption, this habitat showed the lowest species diversity among all study habitats.

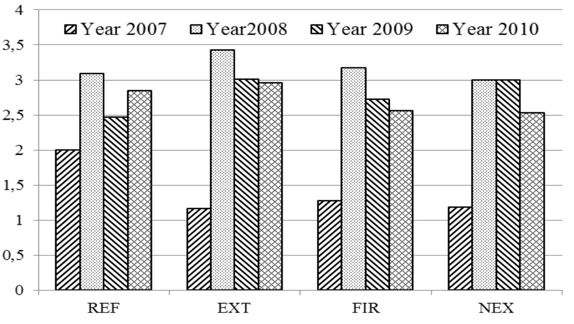

Fig. 7. Species diversity of mites (Shannon H') at study sites

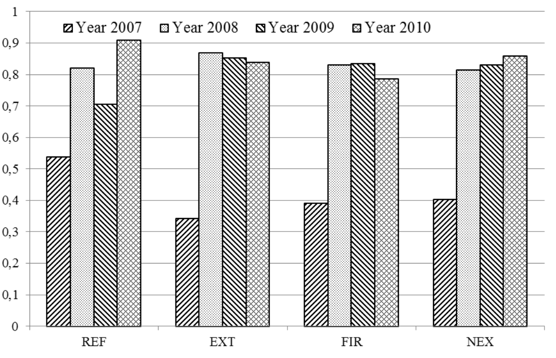

Fig. 8. Equitability of mite species (Shannon E') at study sites

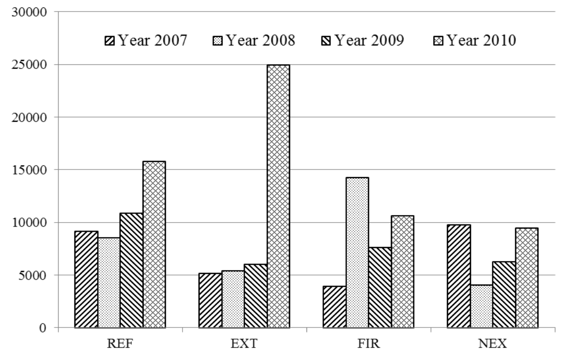

Fig. 9. Density of mite individuals on study sites during the research period

Mite taxocenoses in forest damaged by wind, timber removal and fire influence were characterized by relatively balanced but in comparison with unafected forest the lower species diversity. Likely, also the equitability in mite communities was higher in habitats of undamaged forest. Equitability in mite taxocoenoses followed the species diversity in the year 2007. During the next three years their values increased on damaged sites (Fig. 8) and were similar to those of REF. At the site REF the equitability the most fluctuated during the years 2008-2010 in comparison to other study sites.

The most balanced density of mites (number of individuals.m^{-2}) appeared in EXT site where timber has been salvaged (Fig. 9). The least balanced density of mites were discovered in the wind unafected forest, the site NEX showed the similar tendence. Uninfluenced forest showed the lowest density fluctuation.

At spots of bilberries on FIR site the density mainly of Mesostigmata and Prostigmata remarkably decreased compared to grassy habitats. In all other biotopes with natural growth of bilberries more prostigmatic and mesostigmatic mites occurred like in grassy habitats. The most stabile mite communities occurred in the wind unafected forest (REF), the least stabile ones in the FIR and EXT sites.

A few papers bring the information on soil mites from spruce forests of TANAP (Mrciak 1974, Halašková 1974, Mašán & Fenďa 2004). However, these papers deal with some mite families of former sprue forests. Our results concern mainly damaged area and confirm the occurrence of only some current and widely distributed mesostigmatic mite species presented by the above mentioned authors. Parasitic mites of the family Trombiculidae were studied in TANAP by DANIEL (1974). The important finding of *N. inopinata* in wind influenced forest brings the first data on the occurrence of this species in High Tatras, because this species was not stated from TANAP in the past. In damaged areas of TANAP we found out a varied species spectrum of mites known also from other mountain areas. The composition of dominant species and the taxocenose structure of mites in grassy habitats are similar to mite taxocoenoses of grassy-plant habitats in Nízke Tatry Mts. (KALÚZ 2005). Likely, the structure of mite taxocenoses in plant areas of TANAP is also similar to those of Malá Fatra Mts. (KALÚZ & ŽUFFA 1986, 1988). Some species found there were considered before an exclusively forest species. Forest taxocoenoses of soil mites after disapearing of trees and timber materials (without any respect to influence of wind, fire man etc.) relatively quicky change their structure and species spectrum toward the more adapted and rather meadow types of taxocoenoses. The results presented here enlarge the knowledge on ecological (habitual) demands of mites in the spruce mountain ecosystem. This indicates, that a reclassification of more ecological characters of mesostigmatic and prostigmatic mite species is necessary.

CONCLUSIONS

Soil mites were studied in Vysoké Tatry Mountains over the period 2007 – 2010. They were sampled in Norway spruce stands affected by the wind in November 2004, forestry practices (felling and timber removal) and/or the forest fire (site NEX, EXT, FIR) and in a forest stand not affected by the given factors (reference site, REF), and in different habitats within those forest stands. Mites were obtained from soil samples through photoeclectors in the laboratory. Mite taxocoenoses in particular habitats were characterized and compared against each other. Exposed bare soil hosted a few mite species only. They were represented by mobile species associated with neighbouring habitats covered with vegetation. The rhizosphere of dense layer of *Ch. angustifolium* in EXT, and in FIR, was inhabited by less mite species than the rhizosphere of species-richer plant community with low share of *Ch. angustifolium* in NEX. In the forest with salvaged timber and, also, in the fire affected (burnt) forest, much greater share of meadow as well as mobile mite species was recorded in comparison with the forest with unsalvaged timber where impacts on soil were shown to be less destructive. Thick spruce litter in the forest not affected (REF), and also in NEX, hosted a few mite species only. Here, also, species richness of mite taxocoenoses associated with the rhizosphere of bilberry (*V. myrtillus*) was low. In contrast, the rhizosphere of bilberry in the forest affected by the wind and timber removal and in the forest additionally impacted by the forest fire hosted more mite species. Thick layer of spruce litter under trees (REF) and at places less damaged by impacts (NEX) contained relatively small number of mite species. The values of diversity increased during the next three years and varied about the value

H' = 2.5, on damaged sites with a tendence rather to decrease. Number of mite species varied during the research period and the highest values appeared on all study sites in 2008 and then slowly decreased during the next two years, the lowest values in 2010 were shown on NEX and REF sites. Species diversity was highest in habitats with low herb layer in the not affected forest. Here, also, the highest mite density was documented, whereas the lowest density of mites was typical for the wind-affected forest with salvaged timber. The greatest differences in species diversity over time were documented in the forest affected by the timber removal and/or forest fire, lowest differences were documented in the forest not affected by the wind.

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Table 1. Soil mites on study sites of TANAP during the whole research period (2007-2010)

Mites / Study sites	**REF**	**EXT**	**FIR**	**NEX**	**Štart**	**Σ**
ACARIDAE						
Tyrophagus mixtus Volgin, 1948	5	1		1		**7**
TROMBIDIFORMES - immature stages	41	77	47	4		**169**
EUPODIDAE - immature stages	6	8	5	9		**28**
Cocceupodes molicellus (C. L. Koch, 1838)	346	477	315	75	255	**1468**
Eupodes sp.	64	23	22	51	16	**176**
Linopodes motatorius Linnaeus, 1758	8	4	7	1	4	**24**
PENTHALODIDAE						
Penthalodes ovalis Dugés, 1834		1				**1**
RHAGIDIIDAE - immature stages	5	4				**9**
Coccorhagidia clavifrons (C. L. Koch, 1838)	21	34	10	20		**85**
Poecilophysis (D.) pratensis (C. L. Koch, 1835)	8	15	13	7	2	**45**
Poecilophysis (Proc.) faeroensis (Trägardh,1931)		6	1		5	**12**
Poecilophysis (D.) wankeli Zacharda, 1980		3	1			**4**
Poecilophysis (Sapr.) saxonica (Willmann, 1934)					3	**3**
Robustocheles (Proc.) mucronata (Willmann, 1936)	6	4	2	8	14	**34**
Rhagidia (Noerneria) sp.	6	1				**7**
Shibaia longisensilla (Shiba, 1969)		4	1			**5**
TYDEIDAE						
Tydeus devexus Kuznetzov, 1973	7	3	5	1		**16**
PACHYGNATHIDAE						
Pachygnathus elongatus Duges, 1834	6	3	5	6		**20**
Pachygnathus villosus Duges, 1834		1	3			**4**
TARSONEMIDAE						
Tarsonemus virgineus Suski, 1969			21	3		**24**
PYGMEPHORIDAE - immature stages			26			**26**
Bakerdania gracilis (Sevastyanov, 1974)	1	2	1			**4**
Bakerdania quadrata Ewing, 1939	3	1	3			**7**
Pediculaster mesembrinae (R. Canestrini, 1881)	13	1	3			**17**
SCUTACARIDAE - unidentified	1	3	1	9		**14**
Diversipes sp.		3			2	**5**
Imparipes hungaricus Mahunka, 1962	1					**1**
Imparipes puberulus Sevastyanov, 1974	3	7	1	6		**17**
SITEROPTIDAE						
Siteroptes (Eos.) graminisugus Hardy, 1851	6					**6**
STIGMAEIDAE						
Eustigmaeus pectinata Ewing, 1917	2	2		1		**5**

Mites / Study sites	**REF**	**EXT**	**FIR**	**NEX**	**Štart**	**Σ**
Eustigmaeus segnis (C. L. Koch, 1836)	32	9				**41**
Eustigmaeus sp.	1		26			**27**
Storchia robustus (Berlese, 1885)	1		2			**3**
Zetzellia crassirostris (Leonardi, 1899)	1	1	8	1	5	**16**
BDELLIDAE						
Bdella iconica Berlese, 1923	1	5	3		1	**10**
Bdellodes meridionalis (Thor, 1931)	1	1	3			**5**
Cyta latirostris (Hermann, 1804)	10	2				**12**
CUNAXIDAE - immature stages	2	2				**4**
Cunaxoides biscutum (Nesbitt, 1936)		3	2			**5**
Cunaxa setirostris (Hermann, 1804)		1	1	1		**3**
Cunaxa taurus (Kramer, 1881)	1	8	1			**10**
Cunaxoides parvus (Ewing, 1947)	1	1	7			**9**
NICOLETIELLIDAE						
Nicoletiella denticulatum (Schrank, 1776)	8	22		14		**44**
TROMBICULIDAE						
Neotrombicula inopinata (Oudemans, 1909)	2			1	5	**8**
RHODACARIDAE - immature stages		1				**1**
Gamasellus montanus (Willmann, 1936)	2	2	3			**7**
Rhodacarellus silesiacus Willmann, 1936	1	4	10	12		**27**
PHYTOSEIIDAE - immature stages				1		**1**
Amblyseius agrestis (Karg, 1960)			6	2		**8**
Amblyseius obtusus (C. L. Koch, 1839)	2	2	1			**5**
Amblyseius wainsteini Gomelauri, 1968	8	4	2	2		**16**
HYPOASPIDAE - immature stages	12	12	3	8		**35**
Hypoaspis nolli Karg, 1962	4	12	4	3		**23**
Hypoaspis aculeifer (Canestrini, 1883)	9	36	20	5		**70**
Hypoaspis angusta Karg, 1965	5	1	9	5		**20**
Hypoaspis forcipata Willmann, 1955	2	2	6	5		**15**
Hypoaspis (Pneum.) lubricoides Karg, 1971	20	60	4	8		**92**
Hypoaspis similisetae Karg, 1965	8	26	4	1		**39**
Pseudoparasitus (Olol.) placentulus (Berlese, 1887)	11	9	1			**21**
Pseudoparasitus (Olol.) venetus (Berlese, 1903)	3			13		**16**
ANTENNOSEIDAE						
Antennoseius dungeri (Karg, 1965)	3	1				**4**
Antennoseius avius Karg, 1976	1					**1**
ASCIDAE - immature stages			1			**1**
Arctoseius cetratus (Sellnick, 1940)	2	2	1			**5**
Asca bicornis (Canestrini & Fanzago, 1887)	9	18				**27**
Blattisocius keegani Fox, 1947			1			**1**
PODOCINIDAE						
Lasioseius bicolor (Berlese, 1918)		2	1	1		**4**
MACROCHELIDAE - immature stages		1				**1**
Geholaspis pauperior (Berlese, 1918)	2	3	4	4	1	**14**
EVIPHIDIDAE - immature stages			1			**1**
Eviphis ostrinus C. L. Koch, 1836	4	7	5	2		**18**
VEIGAIAIDAE - immature stages	2	1				**3**
Veigaia nemorensis (C. L. Koch, 1839)	28	10	10	5		**53**
PACHYLAELAPIDAE - immature stages	1	3		3		**7**
Pachylaelaps fuscinuliger (Berlese, 1921)	8	5	1	1		**15**

Mites / Study sites	**REF**	**EXT**	**FIR**	**NEX**	**Štart**	**Σ**
Pachylaelaps karawaiewi Berlese, 1921	2	1	1	3		**7**
Pachylaelaps littoralis Halbert, 1915	7	11	5	2		**25**
Pachylaelaps magnus Halbert, 1915	1	3	2	1		**7**
PARASITIDAE - immature stages	5	12	10	7		**34**
Eugamasus magnus (Kramer, 1876)	1	2				**3**
Leptogamasus (Val.) cuneoliger (Athias-Henriot, 1967)	2	1	1	1		**5**
Leptogamasus nudiglobatus (Athias-Henriot, 1967)	3	2	1	2		**8**
Leptogamasus (Val.) oxalis (Karg, 1968)		1	4		4	**9**
Leptogamasus (Val.) pannonicus (Willmann, 1951)	3	1			1	**5**
Leptogamasus (Val.) pertelicrus (Athias-Henriot, 1967)	2				4	**6**
Leptogamasus (Val.) sinuforceps (Athias-Henriot, 1967)	13	15	19	9	9	**65**
Pergamasus mediocris Berlese, 1904	4	7	8	2	2	**23**
Pergamssus barbarus Berlese, 1906	1	1	2		3	**7**
Holoparasitus calcaratus (C. L. Koch, 1839)	4	1				**5**
ZERCONIDAE - immature stages			5	1		**6**
Parazercon radiatus (Berlese, 1910)	4	11	30	9		**54**
Prozercon kunsti Halašková, 1963		4	7	2		**13**
Prozercon sp.	3					**3**
Zercon carpathicus Sellnick, 1958	6	2	2	2		**12**
Zercon montigenus Blaszak, 1972		5				**5**
TRACHYTIDAE - immature stages	3	5	14	6		**28**
Trachytes aegrota (C. L. Koch, 1841)	2	1			2	**5**
CELAENOPSIDAE						
Celaenopsis badius C. L. Koch, 1836	2					**2**
EPICRIIDAE						
Epicrius mollis C. L. Koch,1836		1				**1**
UROPODINA – non determined	9	1		3		**13**
Spolu	844	1055	755	350	338	**3342**