

DYNAMICS OF THE COURSE OF TRACHEOMYCOSIS INFECTION OF *QUERCUS DALECHAMPII* TEN. ON MONITORING AREAS IN SLOVAKIA DURING THE YEARS OF 1984–1999

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ABSTRACT

Tracheomycosis infection in oaks covered the whole oak territory of Slovakia in the 80th years. The illness in the form of infection spread from east to the west (Požgaj 1986) and whole territory it interfered during three years roughly. It looked disastrous in places. Monitoring areas were established in the years of 1984–1986 to observe the course of infection of individual original oak species. *Quercus dalechampii* Ten. was observed. It was one of the most stricken species during the intense infection attack. Monitoring areas are in Červená Voda, Kvetnica, Pozdišovce and Stáhrad, where its substitution is expressively dominant.

Key words: Tracheomycosis infection, *Quercus dalechampii*, Slovakia.

INTRODUCTION

Quercus dalechampii Ten. seems to be the most represented oak in Slovakia according to the last observations. Its presence in Slovakia has been described by: Magic (1974, 1975), Michalko (1980), Požgaj (1980, 1990) and others (Požgaj, Horváthová 1986; Májovský, Murin 1987; Pagan 1992, 1996; Požgaj 1997, etc).

It belonged to the most stricken oaks (Požgaj 1986) after the outbreak of tracheomycosis infection. After the onset of infection in the years of 1981–1983, mainly in the middle of Slovakia, intensity of the infection reduced its progress, but the infection did not retreat in liquidating demonstration up to day. In 1996 Požgaj and coll. informed about big caducity of *Quercus dalechampii* on Gýmeš, where in 1995 up to 40% of the individuals died.

Generally speaking a lot of work concerning this problem has been done by the workers of VÚLH Zvolen (Příhoda 1984, Čapek 1985, Kocián 1985, Heško 1985), but also workers of SAV (Kubiček, Tomasch 1985, Požgaj 1986, 1987) and others. They were able to identify 5 pathogens from the *Ascomycetes* from the genus of *Ceratocystus*. *C. kubanica* Scerb. – Parf. appeared to be the dominant and the main vector *Scoly intricatus* Ratz. Woodland service defended itself against the infection by sanitarian cutting of stricken and paced individuals, by sanitation of coppices and by reduction of cutting during the vegetal period. The illness was secreted from the beginning for commercial reasons, because physical and mechanical properties of wood were impaired on stricken individuals.

Čapek (1985), Leontovych (1992), Veldeman (1993), Werner (1993) and others were concerned with detection of the cause of disposal infection in biological way.

Monitoring areas (Kubiček, Tomasch 1985) were established at the peak of infection. Their aim was to detect the causes of mass oak mortification, its intense and continuance. We have filled up this network according to the occurrence of original species of *Quercus* L. in Slovakia in order to detect their resistance to this very dangerous illness, which resembles the graphiose of elms (Leach 1935, Heybroek 1966, Greguss 1976).

Manion, Lechante (1992) have ecosystematic hypothesis for formation of analogical illnesses. According to this hypothesis 3 basic kinds of stresses are responsible:

- Longterm actuating factors such as climatic influences, immitted load, wrong standing conditions, longterm deficiency of soily moisture and others

- Factors which amplify the effect of former factors, namely wide scale of biotical damaging factors such as bark beetles and defoliators spongy and poisonous infection
- Accelerating factors. Here we can integrate infectious illnesses caused by high pathogenic and virulencing species of pathogens, mechanical tree abuse, impact of bark beetles and defoliators.

MATERIALS AND METHODS

In our case, as it was said, we focused on the coppices where *Quercus dalechampii* was dominant. The whole monitoring of health condition began by establishing monitoring areas at the time of the most intensive illness of our oaks. We followed the methods according to which 100 individuals would be monitoring in the more accesible landscape and coppices and 50 individuals in the less accesible. In 1984 we established three areas (Kvetnica, Pozdišovce, Stárhhrad) for the *Q. dalechampii* and in 1986 one (Červená Voda). 50 trees were chosen for monitoring in all areas. Each tree was paginated with black number on the white backround. Herbal items were taken from these trees and they are saved at authors. The height was measured by Blumeleiß hightmeasure and circuit stem in $d_{1,3}$ m with tape measure. Phytonotation was accomplished in the area of prompted trees. Land searcher was dud mainly in the middle of

the area for modifying soil type (sensu ÚHÚL Zvolen 1975). The stand was sorted according to Zlatník (1959) into the groups of forest types and according to Hančinský (1972) into the forest types. Soils and phytocenosis from the monitoring areas are described by Požgaj, Nič (2001). The health condition of the trees was eveluated with scale of nine elements (1; 1 -; 2; 2 -; 3; 3 -; 4; 4 -; 5). Basically it is classic five element scale used by Příhoda (1984), Heško (1985), Čapek (1985) etc. supplemented with intermediates (1-, 2-, etc). The health condition was noted within limits once a year from 1984 or 1986 till 1999 and its continuance is expressed either by average value for whole area (calculated according to Požgaj 1987) or for separate trees.

RESULTS

First we will interpret the main local conditions of monitoring areas also with typological units (Tab. 1), description of coppices and characteristics of wood stratum (height, thickness), then figures of individuals in separate health categories, average values of health condition, dynamics of illness through the average values and individuals.

Monitoring areas were established at the second, third and forth forest vegetal level, in vital ecological queue (B) and in acid ecological queue (A) (sensu Zlatník 1959). Monitoring

Table 1. Communities and basic stand characteristics of monitoring areas for observation of *Quercus dalechampii* Ten. health condition

Monitoring area	Forest type group*	Forest type	Exposition	Above sea-level	Geological pad	Orographical classification
Červená Voda	QF	3302	SE	410	sandstone	Čergov
Kvetnica	FQ	2302	S	720	melaphiric series	Nízke Tatry
Pozdišovce	FQ	2307	SE	140	bracical and freshwater pelvisic put awaies	East-Slovak lowlands
Stárhhrad	Fqa	4113	SSW	460	authometa-morphosis granities	Malá Fatra

*Sensu Zlatník (1959)

area Pozdišovce respond to B queue, where is second forest vegetal level (beech – oak) in the group of forest levels *Fageto – Quercetum* with beech – oak forest type on loess clay and loess (2307). Likewise it is in Kvetnica, but with forest type drying blue grass beech – oak forest (2302). Monitoring area Červená Voda respond to third forest vegetal level *Querceto – Fagetum* with the forest type sedge – wood rush oak – beech forest (3302). There was one monitoring area in the queue A (Stáhrad) in the forth forest vegetal level (beechen) in the group of forest types *Fagetum quercino-abietinum* in the forest type bilberry firic beech-like-with oak (4113). In two cases were on the monitoring areas relic oak forests (Kvetnica and Stáhrad).

The monitoring area of Červená Voda represents nice two floor coppice. *Q. dalechampii* composes the overhead floor in the stage of trunking on 60% coppice origin. The underhead floor is made up of thicket of *Carpinus betulus* with *Abies alba*, canopy of main floor reaches up to 75%, stocking 0,6, age from 95 till 125 years, height in 1986 ranged from 18,5 to 31 metres, thickness of the stems from 21 to 48 cm (Fig. 1).

Oak forest of coppice origin, scrubby growth and with non-uniform canopy, which creates the clusters forms the monitoring area in Kvetnica. It is on the extreme relief profile, different ages, canopy of 60%, stocking 0,6. The spotted trees reached 5–15 m in height (Fig. 1), 5 to 40 cm in trunk thickness and grew as old as 147 at the time of foundation.

There is the non-uniform connected coppice on the locality of Pozdišovce, with the trunks more or less lateral branching, canopy 80%, stocking 0,7, in the stage of trunking, the trees over up to 23 m tall in 1984 (Fig. 1), 6–48 cm thick, the oldest reached the age of 100 years (in 1999).

There is protecting forest with thin canopy, scrubby growth, with sinuous stems, with stones, rocks and reef on the surface, with very dangerous terrain, with discontinuous canopy, stocking 0,5. Maximal height of stems is 12 m (1984) (Fig. 1), maximal average of stems is 26 cm, the oldest individuals are more than 100 years old (1999).

The health recourse of *Q. dalechampii* by tracheomycosis affection was monitoring on 50 individuals in all 4 cases. The initial status of health condition in monitoring areas of Kvetnica, Pozdišovce, Stáhrad was from the year of 1984, in Červená Voda from the year of 1986. From following figures (2–5) it is possible to monitor the representation of health categories during the whole monitoring period. For example the representation of health category 1 had decreasing tendency from the beginning of observation till the year 1999 in the localities of Pozdišovce and Stáhrad, in Kvetnica it had variable representation with two tops (1985, 1989), in Červená Voda with expressive minimum in 1997. We can definite state that the biggest increase to the fifth category appeared in the last years of observation on the areas of Kvetnica, Pozdišovce, Stáhrad and one on Červená Voda. There were movements between the

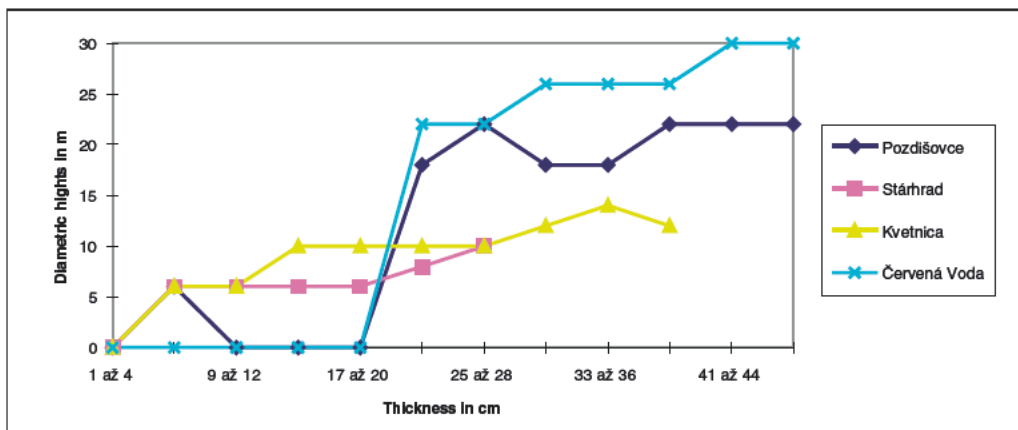


Fig. 1. The representation of the hights in depend of thickness of *Q. dalechampii* Ten. on monitoring areas of Červená Voda, Kvetnica, Pozdišovce and Stáhrad.

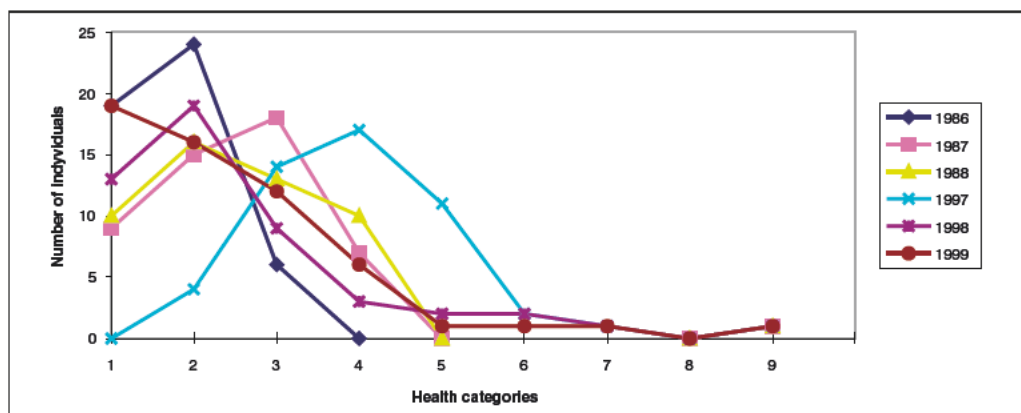


Fig. 2. The number of individuals in health categories in each year during the observation on monitoring area of Červená Voda.

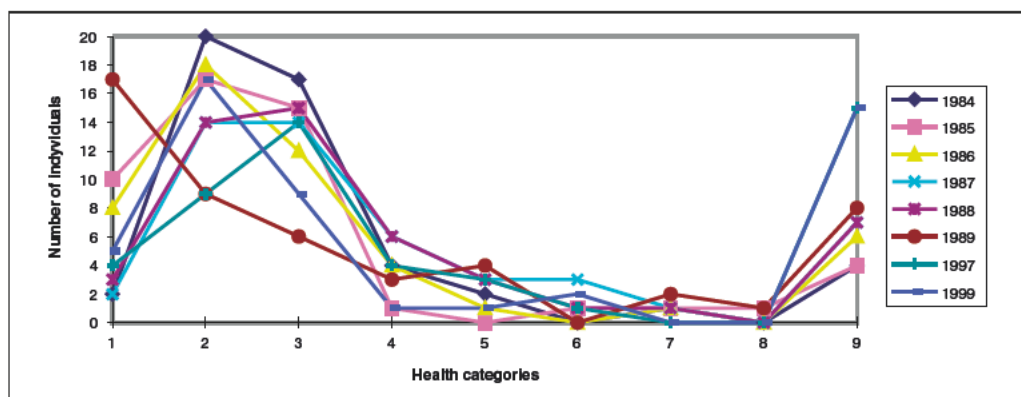


Fig. 3. The number of individuals in health categories in each year during the observation on monitoring area of Kvetnica.

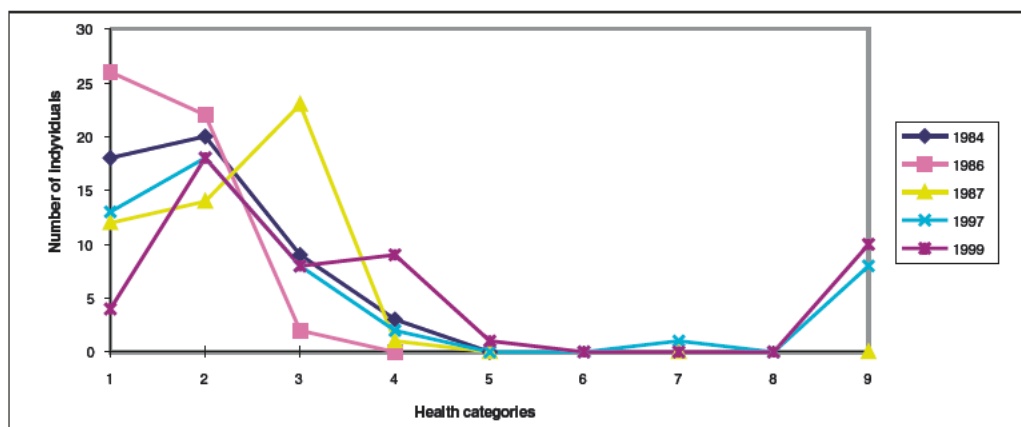


Fig. 4. The number of individuals in health categories in each year during the observation on monitoring area of Pozdišovce.

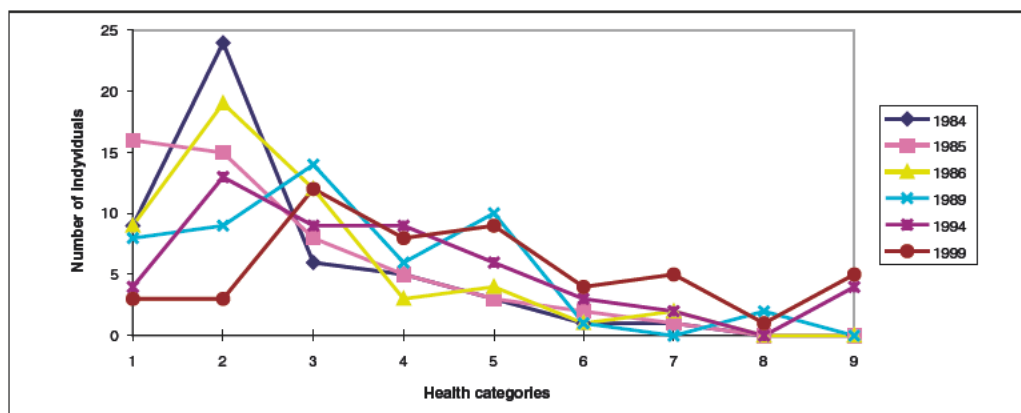


Fig. 5. The number of individuals in health categories in each year during the observation on monitoring area of Stáhrad.

categories 1,1-2 and partly 2-. These movements can characterize the conditions in separate years.

The continuance of average value of health condition of the monitored individuals on the area for each year is shown on the graph in the next figure (6). The worst health condition were registered on the area of Kvetnica during the whole monitoring, the best in Pozdišovce. The common property of the monitoring areas of Kvetnica, Stáhrad was that the health condition does not grow worse in the year of 1985 and in Kvetnica and Pozdišovce not even in 1986 against initial status. The common property of all areas was tendency of decreases of health

condition against initial status. The top of the worst health condition from all years and monitoring areas was in Kvetnica in 1997 and in Stáhrad in 1999. The best was in Pozdišovce in 1986. The best health condition have been recorded in Červená Voda at the end of monitoring.

Relatively interesting is monitoring from which health condition there was a more of the stricken trees to the category 5, from which worst category a way back is possible and so on. The trees come to category 5 from different initial health categories. For example on Kvetnica arrived to the creation of 5 category on the tree number 47 in this way: 2 – (in 1984),

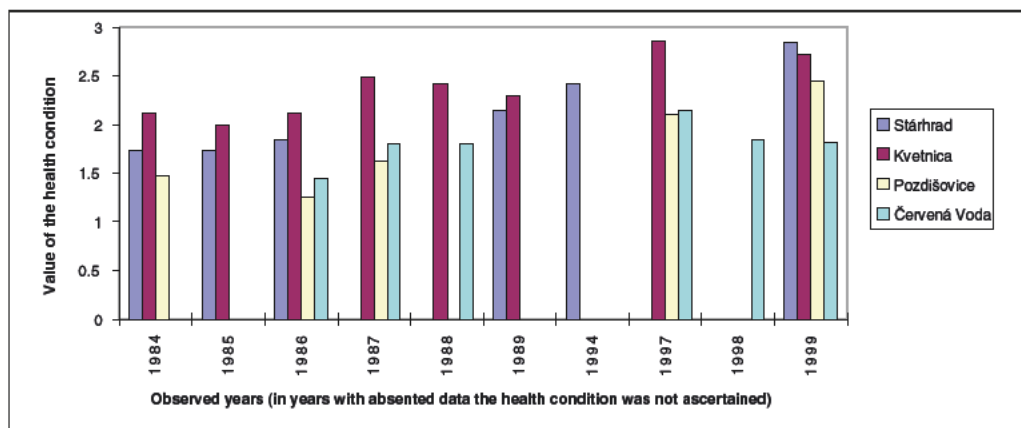


Fig. 6. The health condition of *Q. dalechampii* Ten. on the monitoring areas of Stáhrad, Kvetnica, Pozdišovce, Červená Voda in the years of 1984/1999.

2 (1985), 2 – (1986), 4 (1987), 4 (1988), 5 (1989) which is rough standard case. There was also the case in which the first three measurements had 1 or even 1989 1-. We did not register any designation before mortification of the tree, till instability of the health categories after the consecutive year or continuous formation of the exasperation of health condition signaled the mortification. However there were individuals which were able to outgrow from category 3 to category 1 – (the tree number 22 on the area of Stárhhrad), or tree number 20 in Kvetnica from category 3 – (1987) to 1 – in 1999. Both examples are only from the whole monitoring. The main reorganisation occurred by decreasing, descending or unstable trend between 1, 1-, 2.

Also very interesting is the initial position of paced trees according to sociological position in the vesture. In Kvetnica area the biggest caducity (15 pieces) was observed. The individuals came out from all categories of height. The group of smaller trees under the number 3–10 completely died and left there the bear plain. One of the highest trees (15 m) also dropped out (Fig. 2). In the case of thickness it was likewise.

As a consequence of tracheomycosis affection in Pozdišovce 6 trees dropped out. The trees 13, 21, 37, 44 dropped out in consequence of obscuration.

5 individuals dropped out in Stárhhrad, all as a result of tracheomycosis affection. 1 individual died in Červená Voda monitoring area during our monitoring, the tree 18 (28 m high) passed from health category 1 – to category 4.

DISCUSSION

First of all we would like to refer to an analogy of grafiose of elms (Greguss 1974) in the 50s with affection of oaks in 80th years. First the illness took its name from elms, i. E., graphiosic affection of oaks, then it changed into collective caducity of oaks and finally when the real cause (attack of tracheae) was discovered the illness was called tracheomycosis affection of oaks (Heško 1985). First of all service workers warned against the illness of oaks in the years 1980–1982 and then VÚLH Zvolen employed all its resources to solve the

problem and reduce its impact on the oaks. At first the chances of success were slim. Acute course of illness (Čapek 1985) caused that the attacking individuals died during the few weeks. The individuals fell down in circles (like grow mushrooms). Also SAV under leadership of Kubíček (Kubíček, Tomasch 1985) embarked on the solution of this serious problem. Both state research tasks (VULH, SAV) were examined by professors Křístek and Stolina in Kamenný Mlyn near Malacky. There have arisen some statements. Prof. Stolina's view on this is: "... that it is only a temporary illness resembling that in Yugoslavia at the beginning of 20th century". We agree with this statement. At the moment some of the *Q. dalechampii* coppices are broken owing to that illness (Stárhhrad, Kvetnica, Gýmes (Požgaj and coll. 1996) etc). All the oak species were injured (Požgaj 2000). The condition of some trees has been by all accounts, improving (Kvetnica, Červená Voda) and of others deteriorating (Pozdišovce, Stárhhrad).

CONCLUSION

After 1984 the health condition under the influence of tracheomycosis infection became worse. It could be demonstrated the 16-years observations of *Q. dalechampii* health condition on 4 monitoring areas. Acute infection did not acute during vegetation period, but individual gradual mortifications were manifested. Within several years observations have shown relatively frequent individual transformations from the health category 1 to health category 1 – or 2. At the same time there was also reorganisation from the health category 2 – to categories 1, 1-, 2. In one case the health condition improved from the health category 3 – to the category 1 – during observing years. In another case was similar situation, from category 3 to category 1-. But majority of individuals step went to the health category 5 during observing years. On 2 monitoring areas Červená Voda (in the years 1998 and 1999) and Kvetnica (1999) the health conditions improved. The worst health conditions were on areas Pozdišovce and Stárhhrad in the year 1999.

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