

# Kladistický přístup (parsimonická analýza)

## Hennig, W.

1950: *Grundzüge einer Theorie der phylogenetischen Systematik.*

Deutsche Zentralverlag, Berlin.

1965: Phylogenetic systematics. *Annual Review of Entomology* 10: 97-116.

1966: *Phylogenetic systematics.* University of Illinois Press, Urbana.

## Botanická kladistika:

Koponen, T., 1968: Generic revision of Mniaceae Mitt. (Bryophyta).

*Ann. Bot. Fenn.* 5: 117-151.

Funk, V. & Stuessy, T. F. 1978: Cladistics for practicing plant taxonomist. *Syst. Bot.* 3: 159-178.

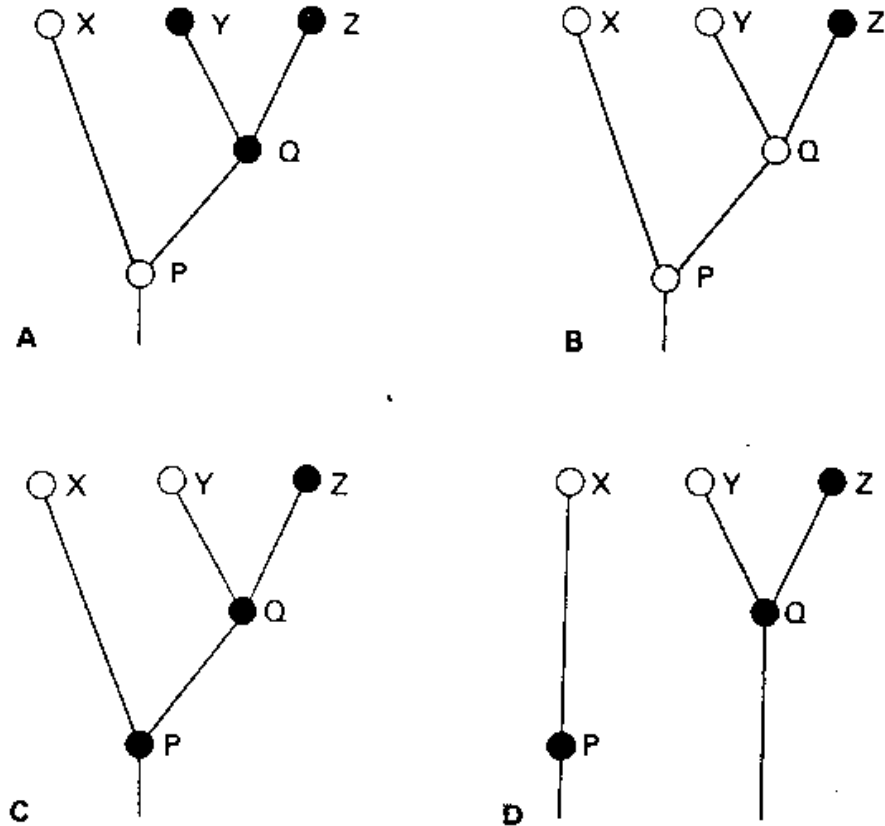
Bremer, K. & Wantorp, H.- E. 1978: Phylogenetic systematics in botany. *Taxon* 27: 317-329.

**A** Y-Z, X-Y-Z  
monofyletické skupiny

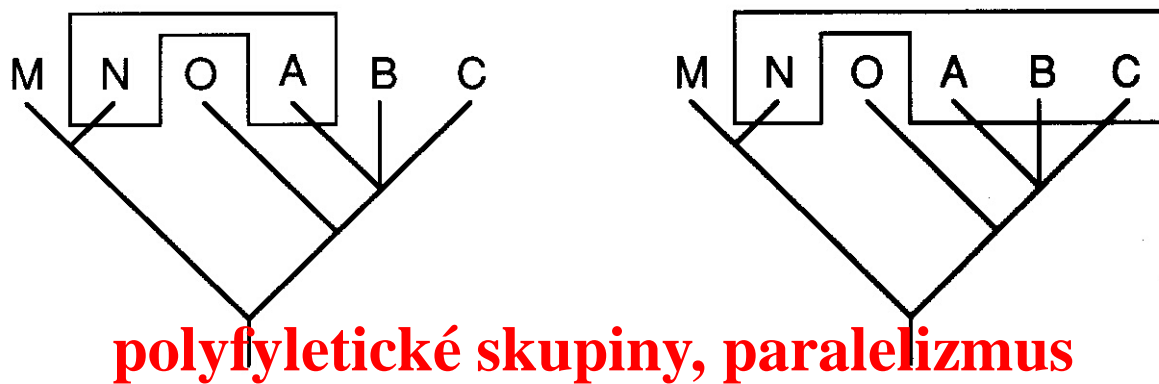
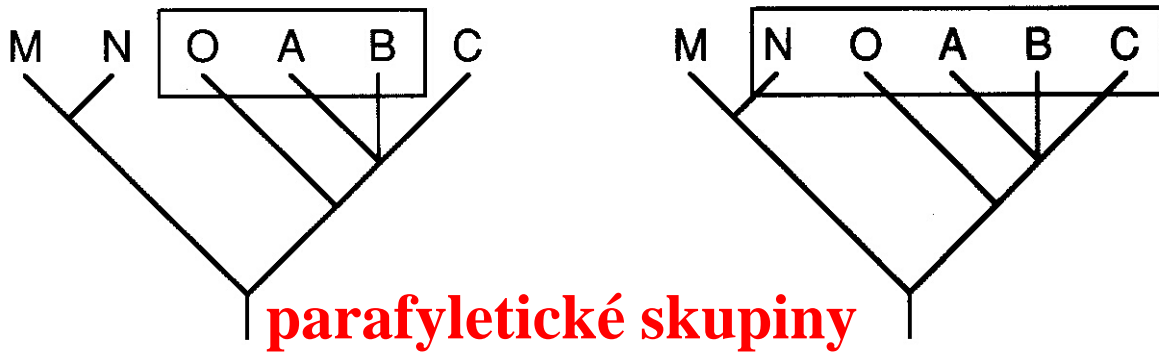
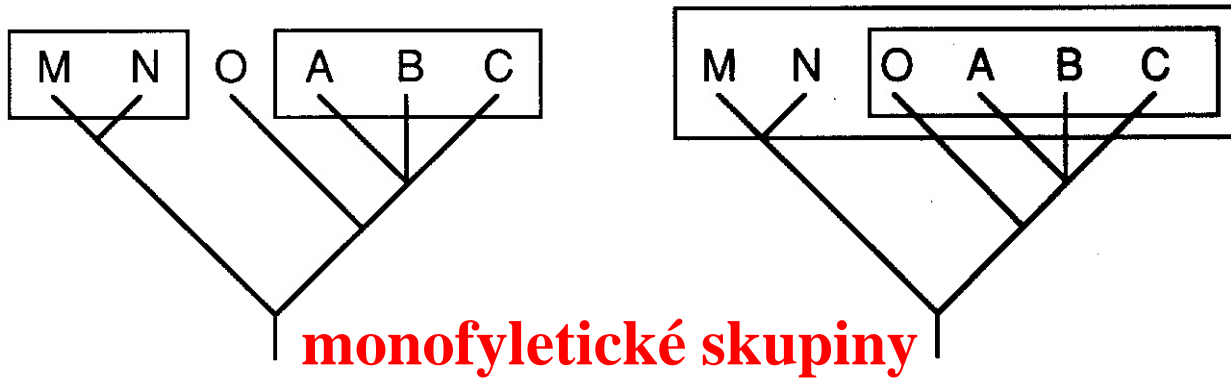
**B** X-Y parafyletická  
skupina

**C** X-Y polyfyletická  
skupina, paralelizmus

**D** X-Y polyfyletická  
skupina, konvergencia



**Fig. 2.6** Four diagrams showing different origins of three species (X, Y, Z) from the ancestral taxa P and Q in order to illustrate the concepts of monophyly, paraphyly, polyphyly, parallelism and convergence. The possession of one or other of two contrasting character-states by each of the five taxa is indicated by an open or closed circle respectively. **A.** Groups YZ and XYZ are both monophyletic; the similarity between Y and Z is a synapomorphy; the difference between X and YZ is due to divergence. **B.** Group XY is paraphyletic; group XYZ is monophyletic; the similarity between X and Y is a symplesiomorphy; the difference between Y and Z is due to divergence. **C.** Group XY is polyphyletic; group XYZ is monophyletic; the similarity between X and Y is a false synapomorphy caused by parallelism. **D.** Groups XY and XYZ are both polyphyletic; group YZ is monophyletic; the similarity between X and Y is a false synapomorphy caused by convergence.



## **Primitívny stav znaku**

Pleziomorfia

Sympleziomorfia

## **Odvođený stav znaku**

Apomorfia

Autapomorfia

Synapomorfia

**Homoplázia** = konvergencia + paralelizmus

**Taxón** - skupina organizmov, ktorá nesie nejaké meno

**Stupeň taxonomickej hodnoty, kategória, rank**

(pozor: nezamieňať rank s existenciou taxónu ako skupiny)

**Grade (stupeň)** - často parafyletické a niekedy polyfyletické skupiny, predstavujú istú úroveň evolučného procesu, napr. Vermes, Reptilia

**Príbuzenstvo** - genealogické vzťahy, čisto fenetická príbuznosť je explicitne vylúčená

**Ingroup** - študovaná skupina

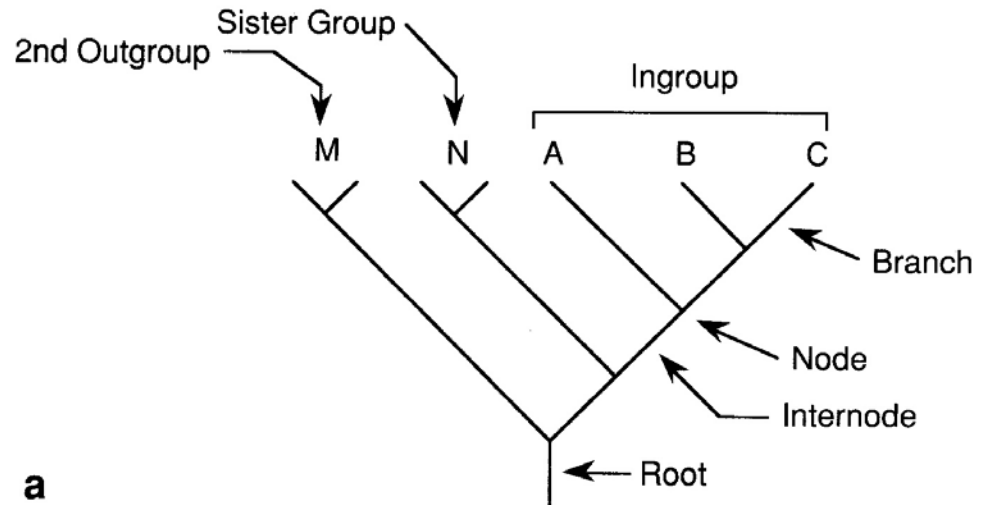
**Sesterská skupina**  
(sister group)

**Mimoskupina**  
(outgroup)

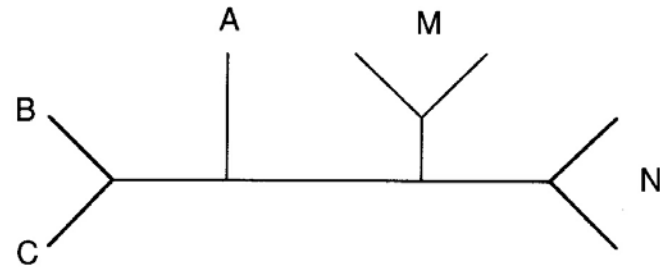
**Polarizácia znakov**

**Mimoskupinové porovnania** (outgroup comparison)

**Uzol** (node) - špeciálna udalosť, vznik druhu



a



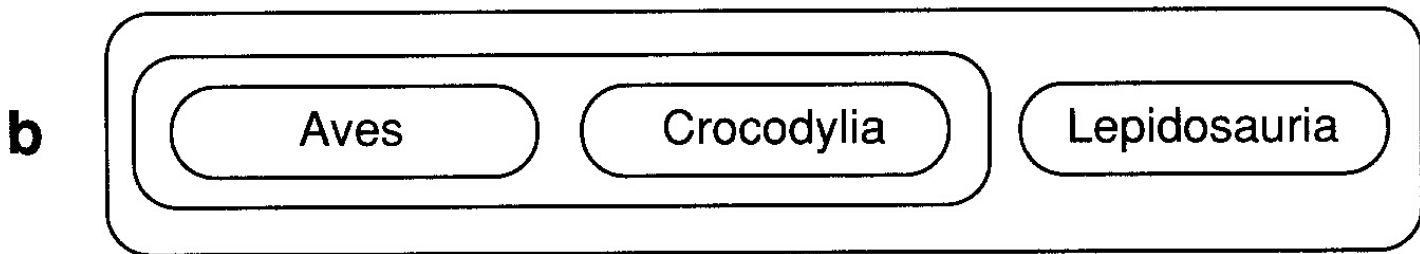
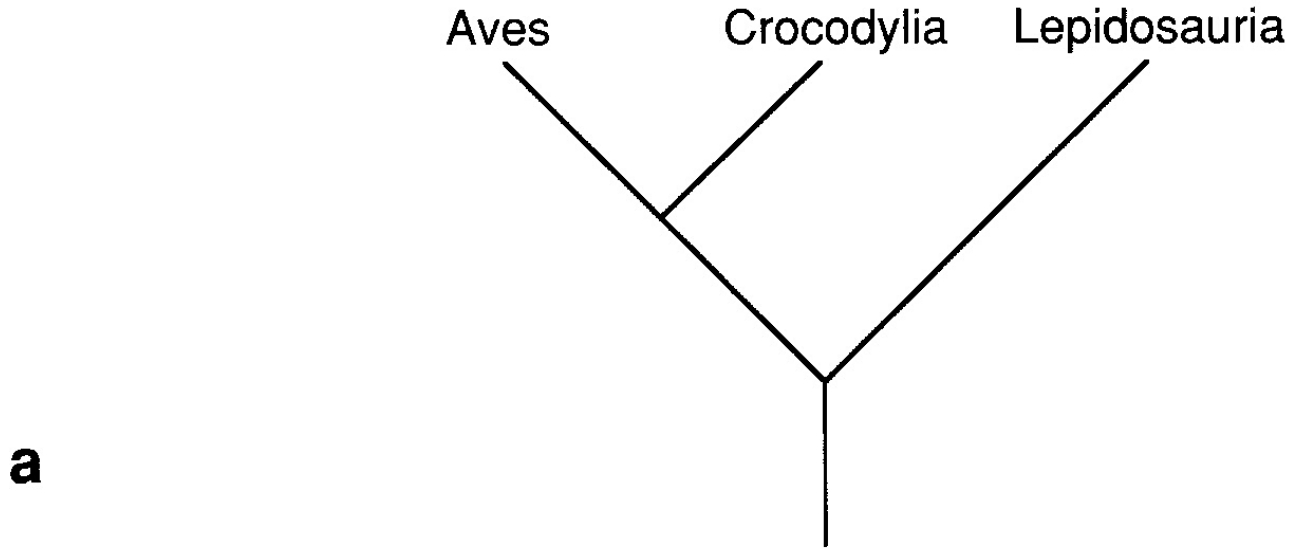
b

**Konár** (branch)

**Medziuzly** (internode)

**Koreň** (root)

**Strom zakorenený - nezakorenený**



**Vennov diagram (Venn diagram)**

**Znak** (character) - stavy znaku (character states)

**Transformačná série** (transformation series) - znaky (characters)

**Polarizácia znakov** (character polarisation)

**Homoplázie** = konvergencie + paralelizmy

**Pleziomorfický** (plesiomorphic) - **apomorfický** (apomorphic) stav znaku (konvencia: 0 primitívny stav, 1 odvodený stav)

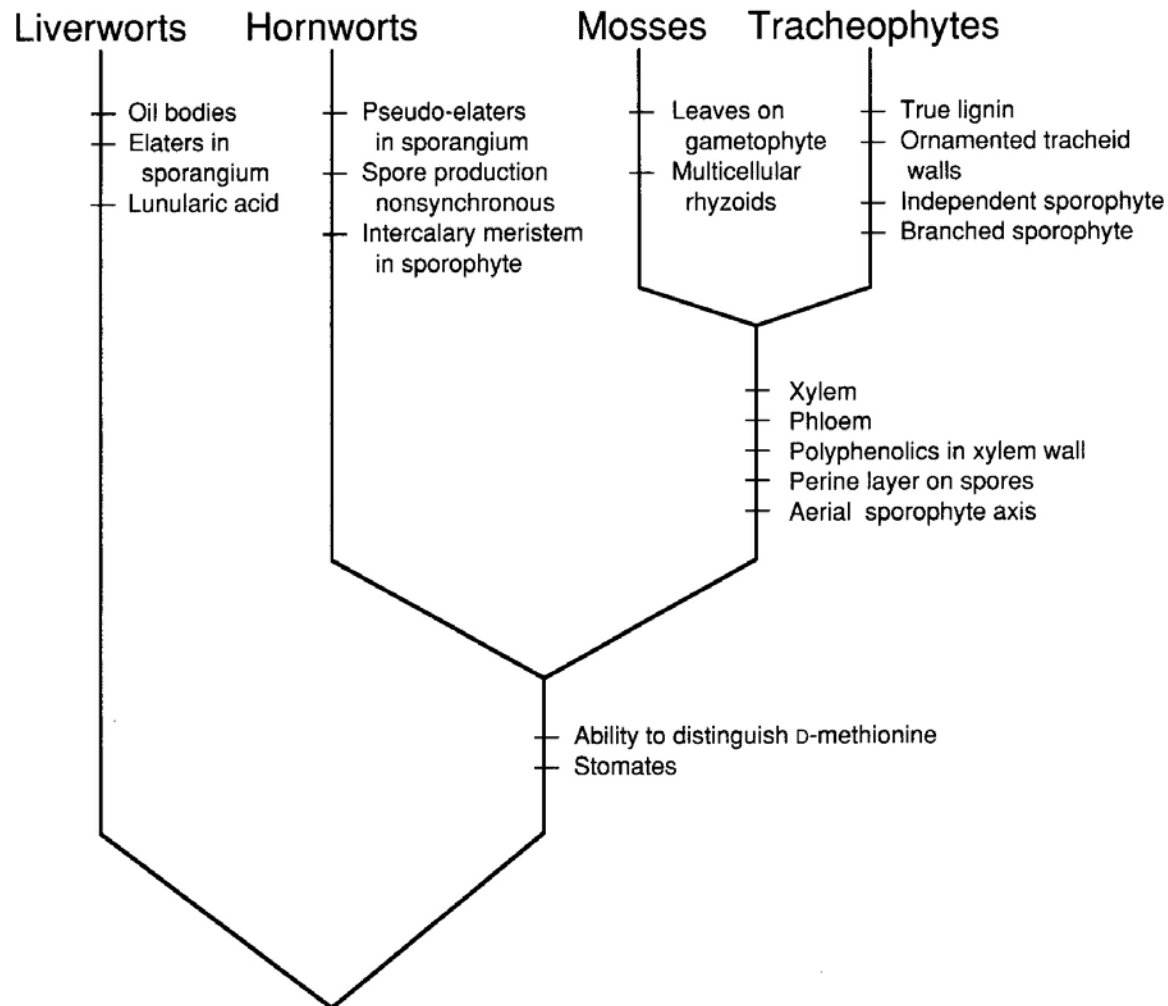
**Znaky** usporiadané - neusporiadané





**Polarizácia znakov** - založená na *a priori* argumentoch

**Optimalizácia znakov** - je *a posteriori* postup, pri ktorom sa optimalizuje polarizácia znakov vzhľadom k danej topológii stromu

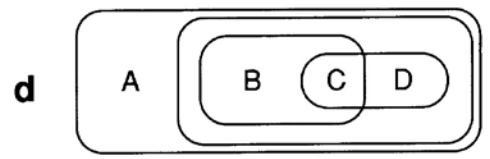
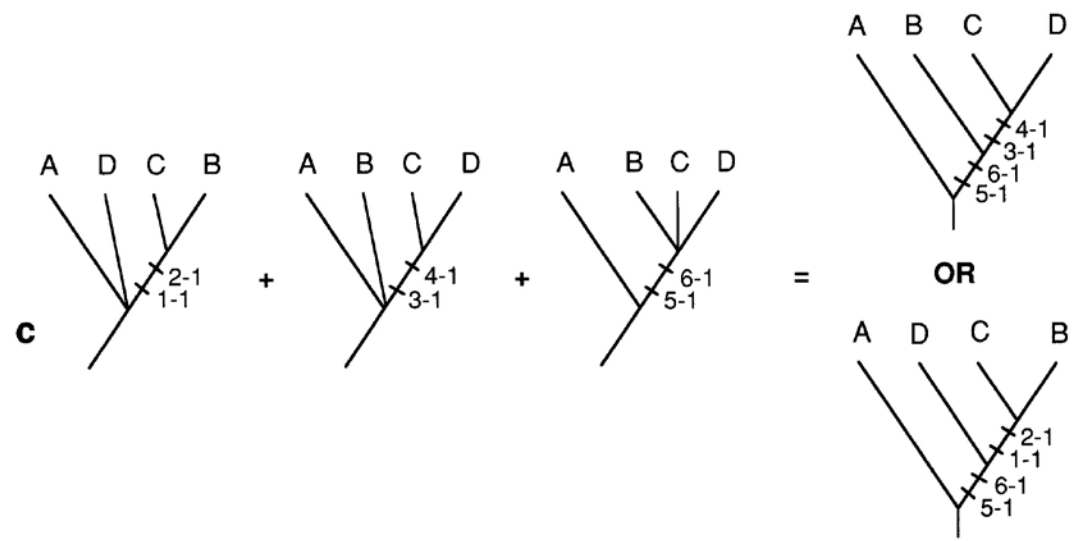
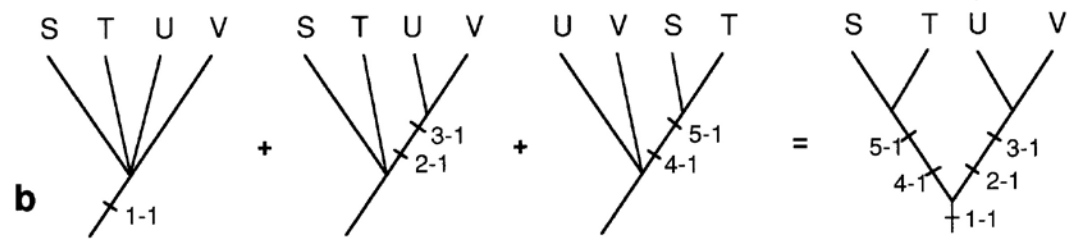
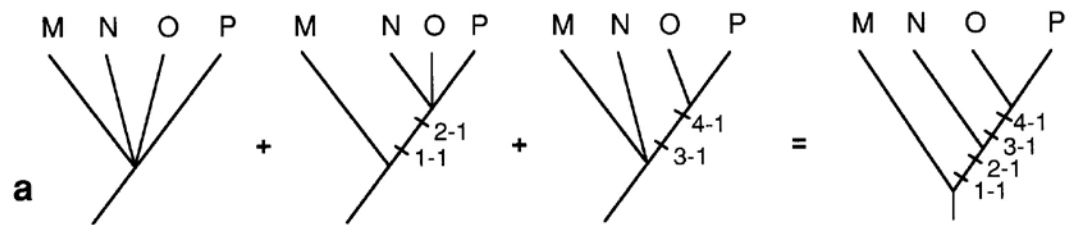


**Fylogenetická systematika vychádza z predpokladu, že existuje jedna historicky unikátna genealogická história všetkých organizmov. Pretože znaky sú vlastnosťami organizmov, musia byť umiestnené na strom, ktorý reprezentuje túto históriu.**

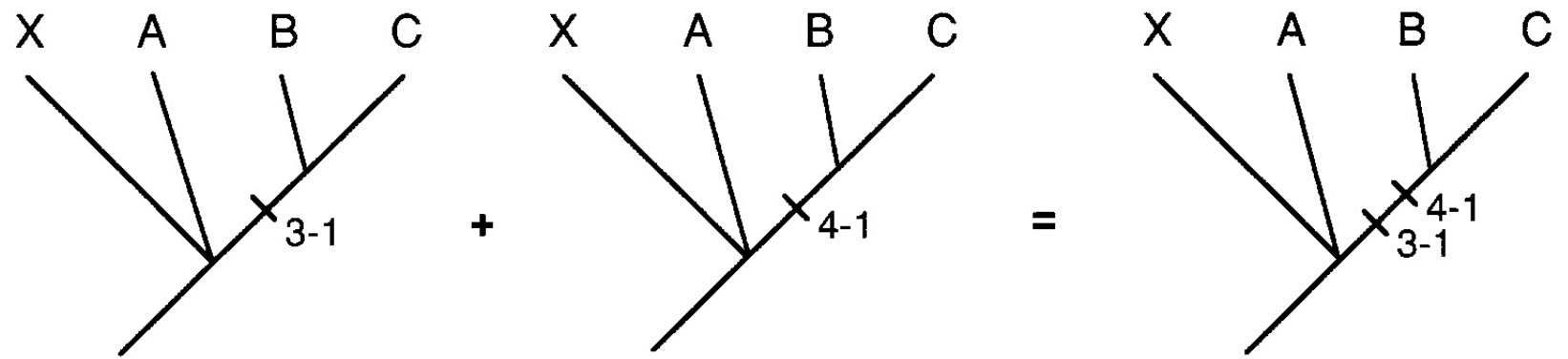
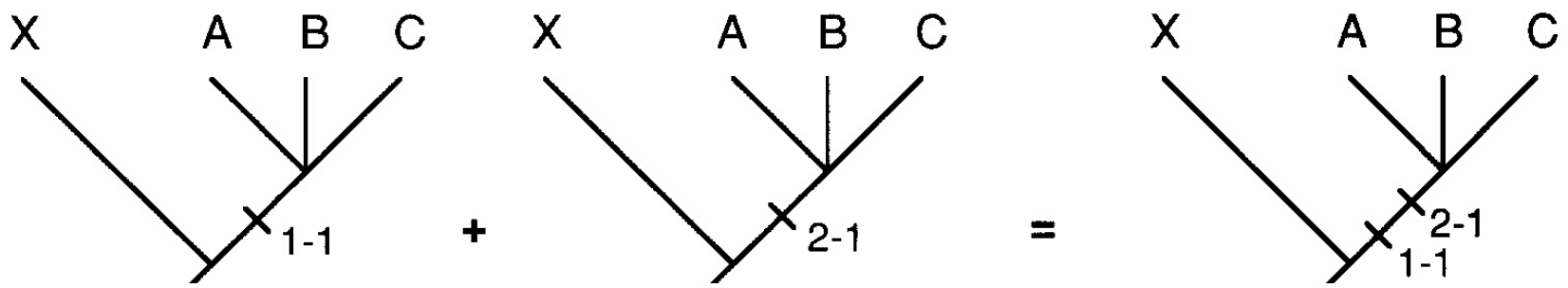
**Hennigov pomocný princíp (Hennig's auxiliary principle)** - nikdy nepredpokladáme konvergenciu alebo paralelnú evolúciu, vždy, ak nemáme dôkazy o opaku predpokladáme homológiu.

**Pravidlo zoskupovania (grouping rule)** - synapomorfie sú dôkazom pre spoločný pôvod, kým sympleziomorfie, konvergenzie a paralelizmy sú nepoužiteľné pre tento účel.

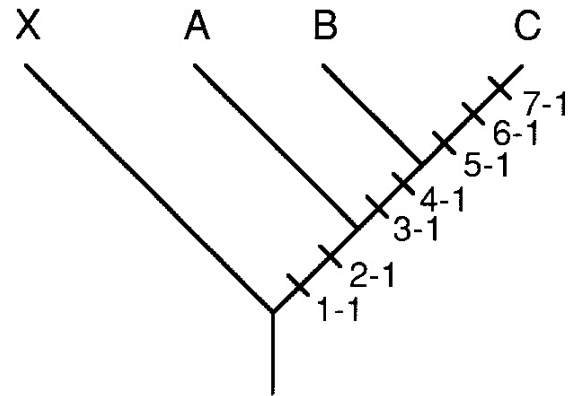
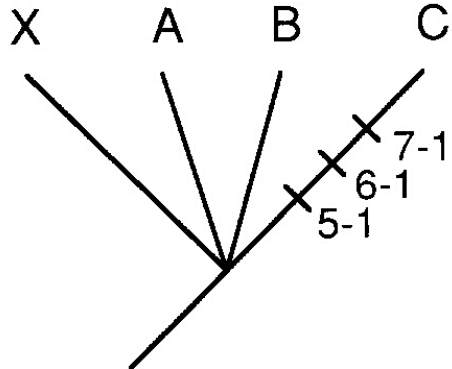
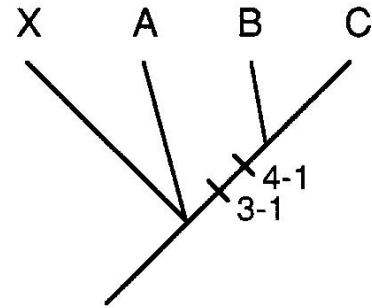
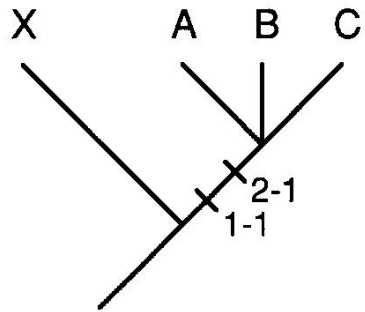
**Pravidlo zahrnutia/vylúčenia (inclusion/exclusion rule)** - informácia z dvoch transformačných sérií môže byť kombinovaná do jednej hypotézy (stromu) len vtedy, ak dovoľuje kompletne zahrnutie alebo kompletne vylúčenie skupín, ktoré sú tvorené jednotlivými transformačnými sériami. Prekryv skupín vedie ku tvorbe dvoch alebo viacerých hypotéz pretože informáciu nemožno skombinovať do jednej hypotézy.



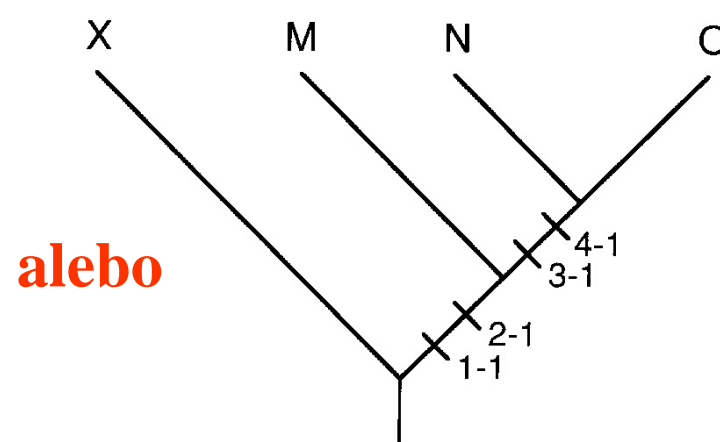
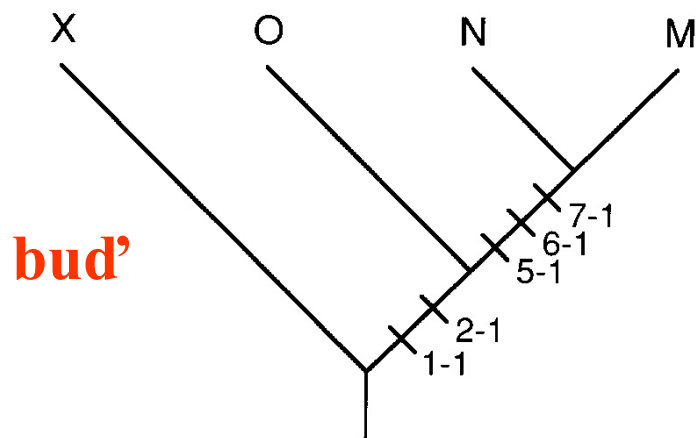
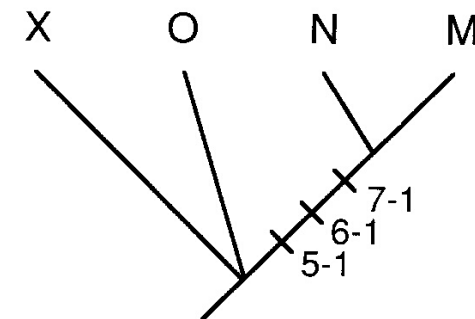
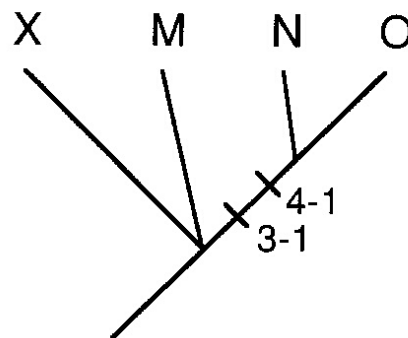
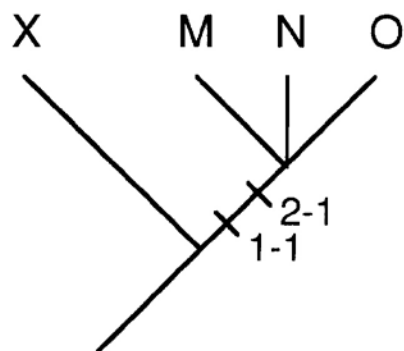
Taxon	Transformation series						
	1	2	3	4	5	6	7
X (outgroup)	0	0	0	0	0	0	0
A	1	1	0	0	0	0	0
B	1	1	1	1	0	0	0
C	1	1	1	1	1	1	1

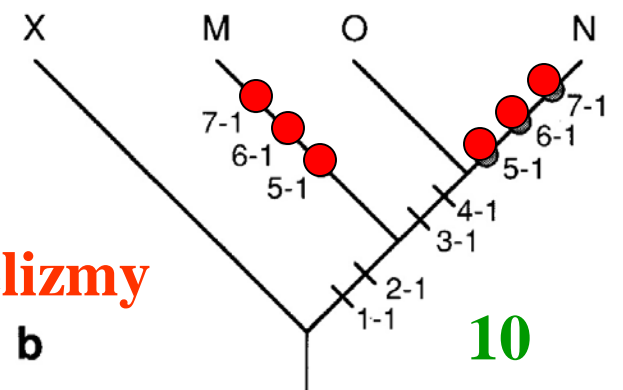
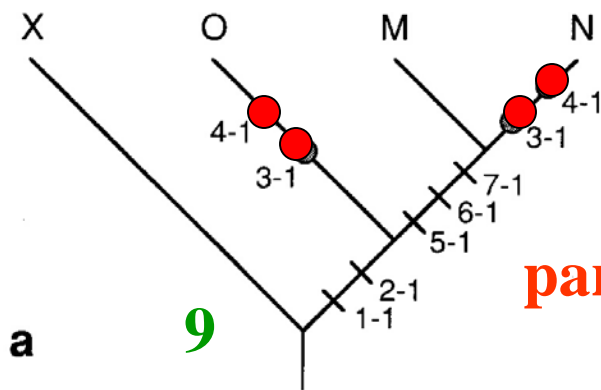
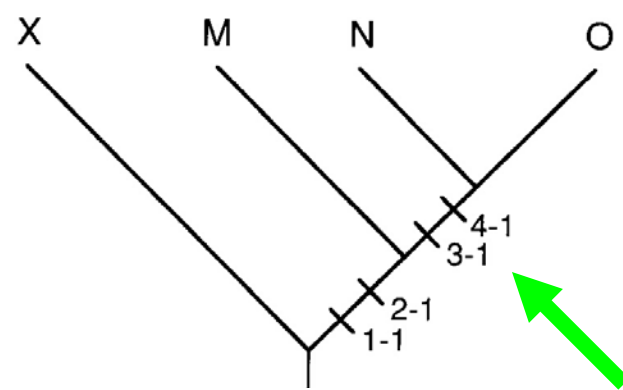
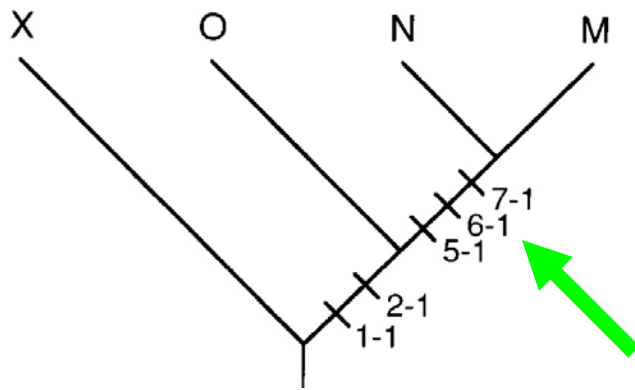


Taxon	Transformation series						
	1	2	3	4	5	6	7
X (outgroup)	0	0	0	0	0	0	0
A	1	1	0	0	0	0	0
B	1	1	1	1	0	0	0
C	1	1	1	1	1	1	1

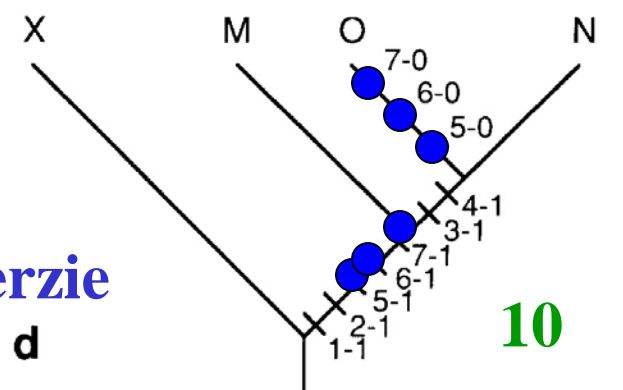
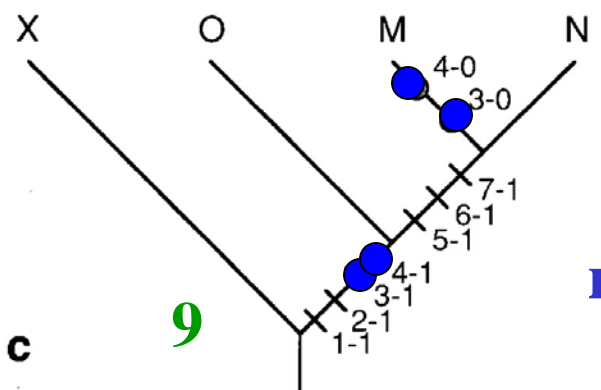


Taxon	Transformation series						
	1	2	3	4	5	6	7
X (outgroup)	0	0	0	0	0	0	0
M	1	1	0	0	1	1	1
N	1	1	1	1	1	1	1
O	1	1	1	1	0	0	0





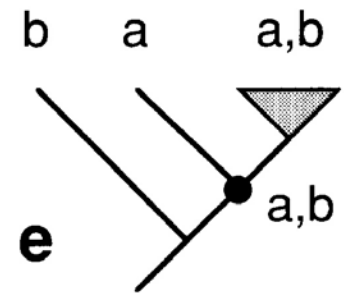
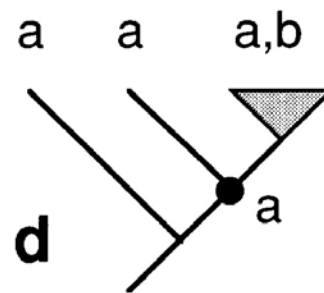
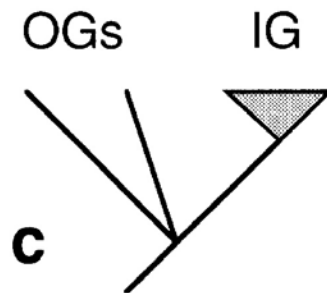
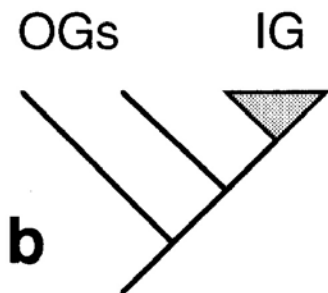
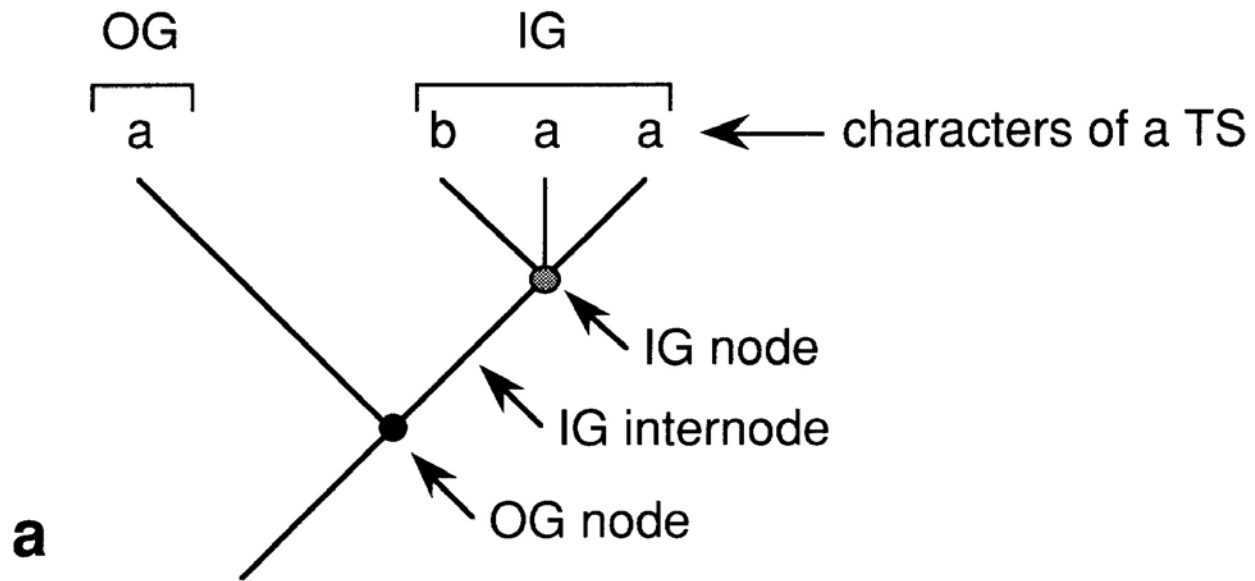
paralelizmy



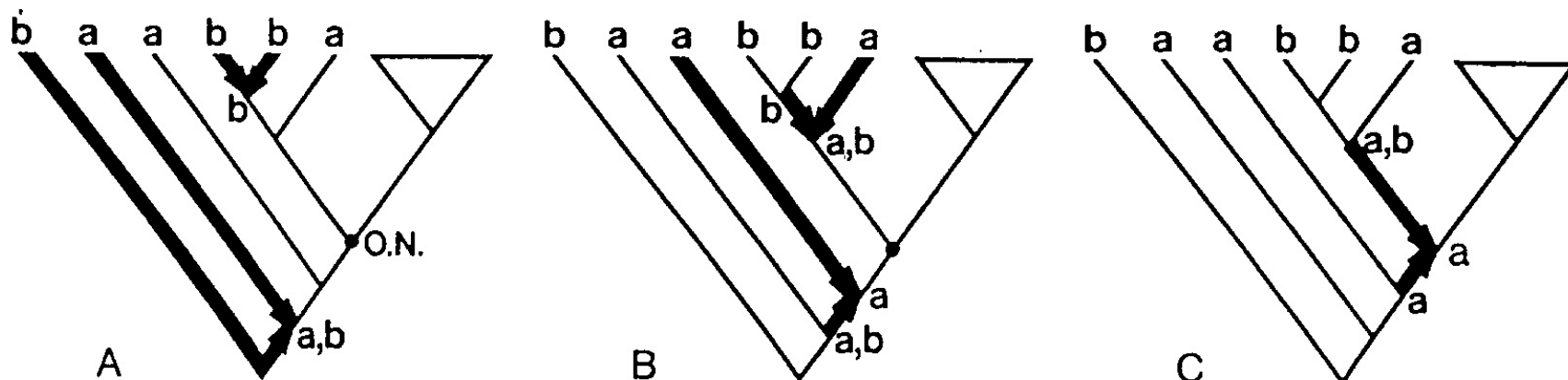
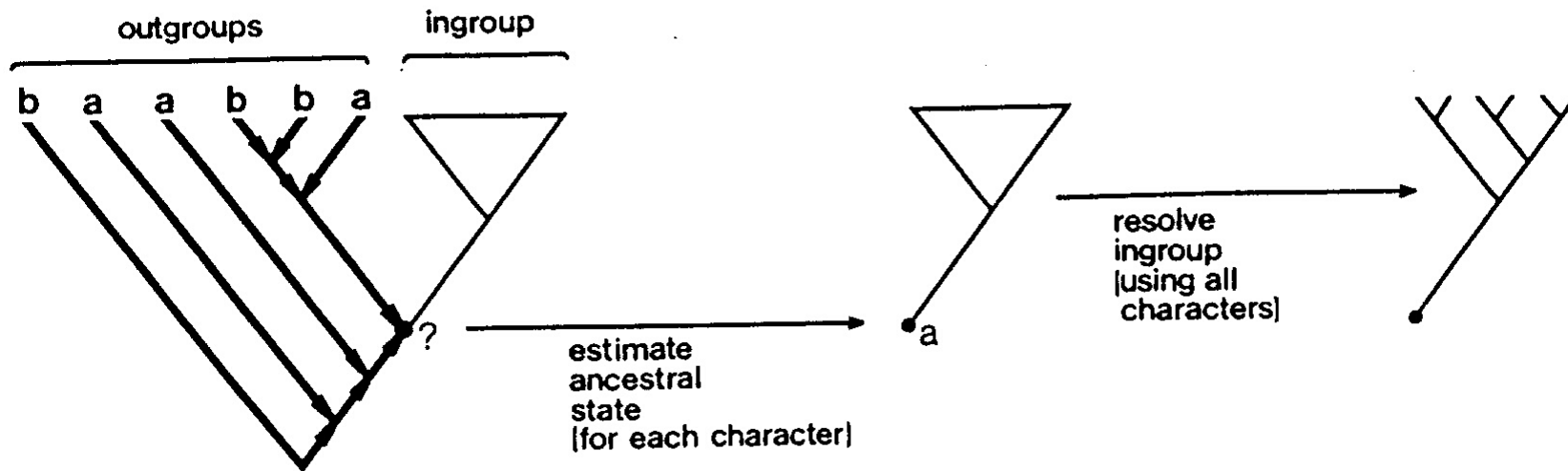
reverzie



## Mimoskupinové porovnanie (outgroup comparison)

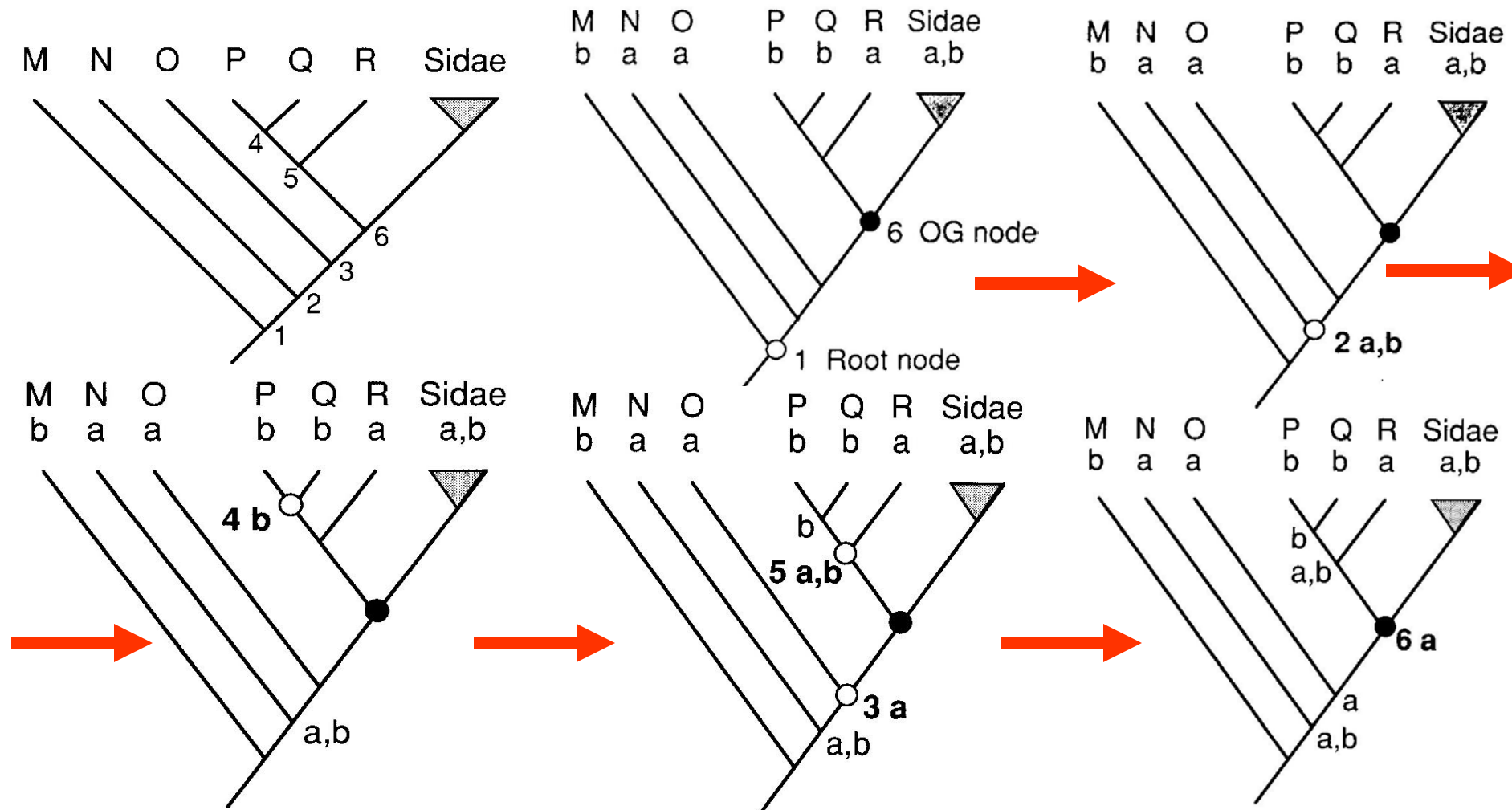


# Mimoskupinové porovnanie (outgroup comparison) väčší počet mimoskupín

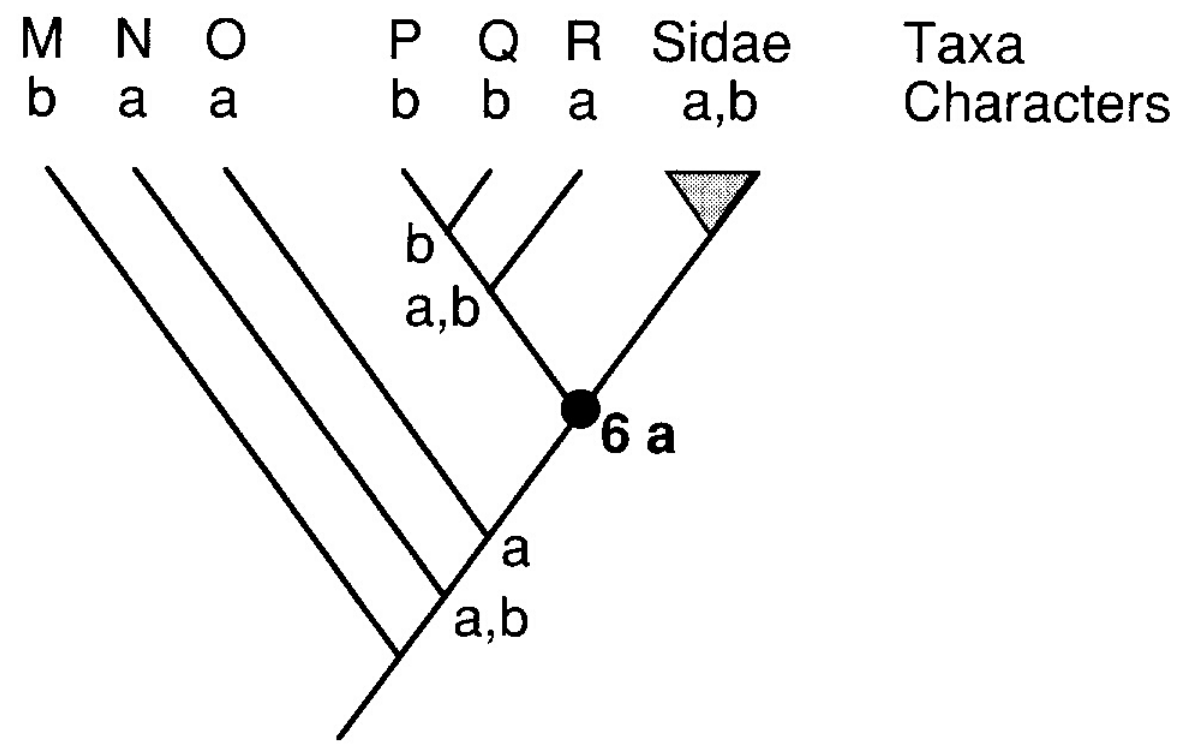


Taxon

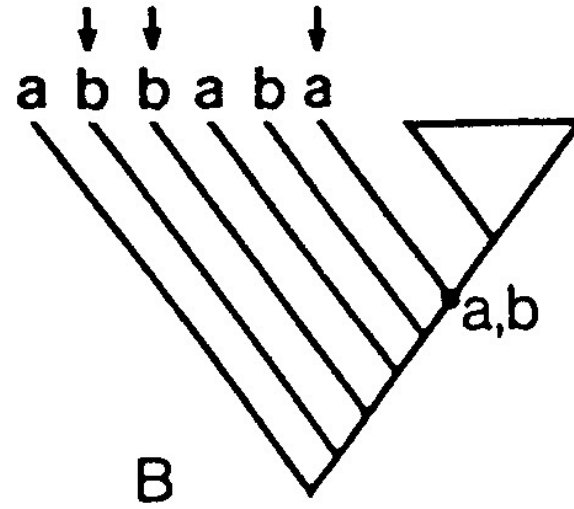
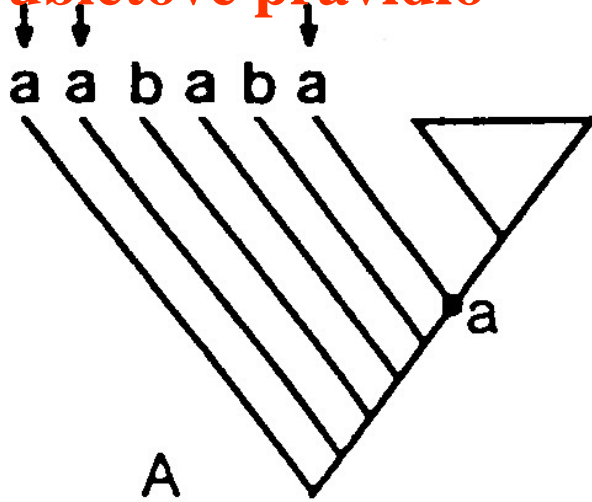
TS	M	N	O	P	Q	R	Sidae
1	b	a	a	b	b	a	a,b
2	b	b	a	b	b	a	a,b
3	a	b	b	b	b	a	a,b
4	a	a,b	a	b	b	a	a,b



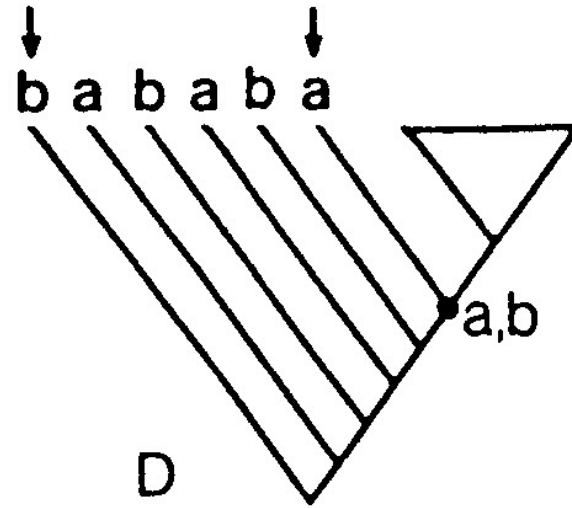
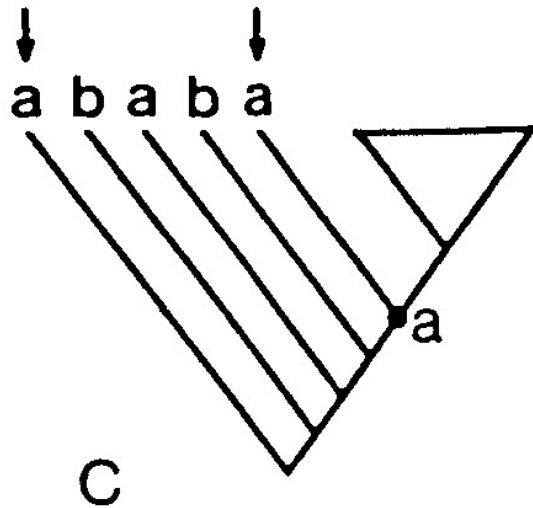
TS	Taxon							Sidae
	M	N	O	P	Q	R		
1	b	a	a	b	b	a	a,b	
2	b	b	a	b	b	a	a,b	
3	a	b	b	b	b	a	a,b	
4	a	a,b	a	b	b	a	a,b	



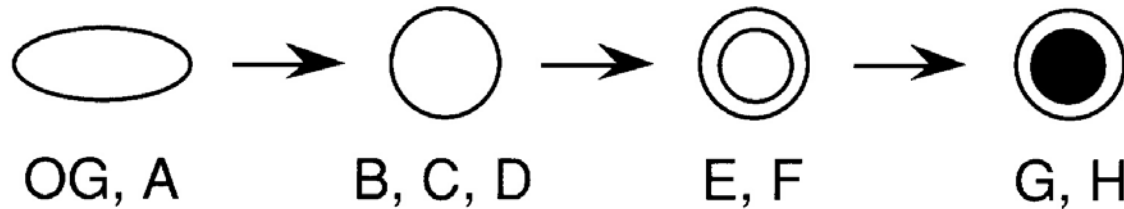
## Dubletové pravidlo



## Pravidlo alternujúcich mimoskupín

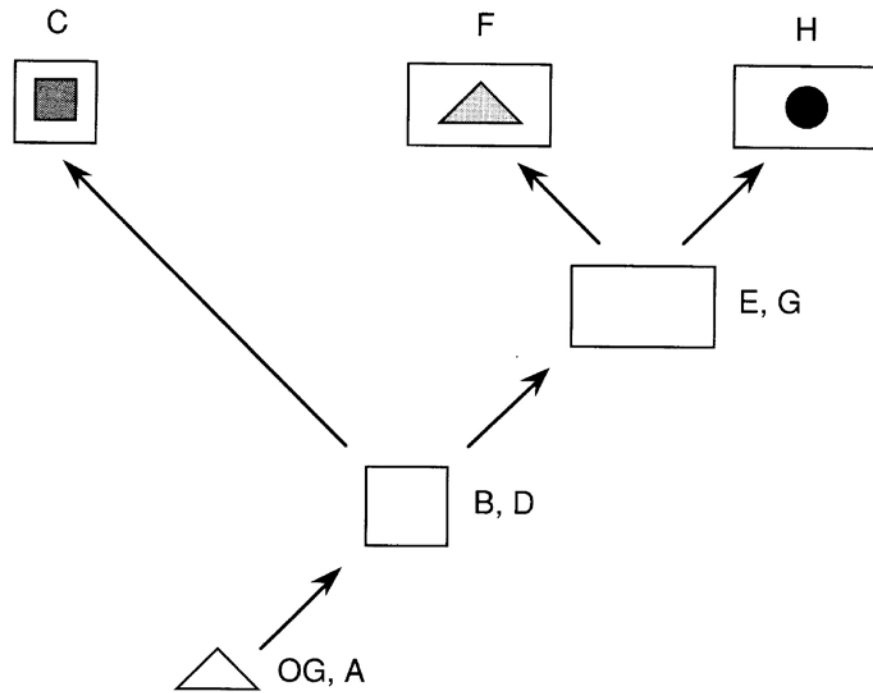


# Kódovanie znakov - lineárne transformačné série



Taxon	Linear coding	Additive binary coding*			
		C + C/C + C/D	C/C + C/D	C/D	C/D
OG	0	0	0	0	0
A	0	0	0	0	0
B	1	1	0	0	0
C	1	1	0	0	0
D	1	1	0	0	0
E	2	1	1	0	0
F	2	1	1	0	0
G	3	1	1	1	1
H	3	1	1	1	1

# Kódovanie znakov - rozvetvené transformačné série



Taxon	All except T	S/S	R+	R/D	R/T	T+S+R+R/D	S/S	R/T
OG	0	0	0	0	0	0	0	0
A	0	0	0	0	0	0	0	0
B	1	0	0	0	0	1	0	0
C	1	1	0	0	0	1	1	0
D	1	0	0	0	0	1	0	0
E	1	0	1	0	0	2	0	0
F	1	0	1	0	1	2	0	1
G	1	0	1	0	0	2	0	0
H	1	0	1	1	0	3	0	0

neaditívne binárne

zmiešané