RESULTS

RESULTS

The distribution of various flavones, flavonols, glycoflavones, proanthocyanidins, phenolic acids, aucubins and alkaloids among the 99 members belonging to the Acanthaceae is presented in the Tables 3, 4 and 5.

Of the 99 taxa screened, 76 contained various flavonoids, such as flavones, flavonols, glycoflavones and proanthocyanidins.

Flavones :

The Acanthaceae appears to be flavone-rich. Of the 14 flavone aglycones obtained, four were 6-oxygenated, found in 22 plants and 6-deoxygenated flavones were observed in 53 taxa. In thirteen plants, 6-deoxygenated flavones co-occurred with 6-oxygenated flavones and in five plants, they occurred with glycoflavones while 6-deoxygenated flavones co-occurred with proanthocyanidins in only one plant i.e. *Elytraria crenata* Vahl.

Flavones undoubtedly formed the predominant flavonoid pigment in this family.They are echioidin, apigenin, acacetin, 7'-OMe luteolin, 3'-OMe luteolin, 7,4'-diOMe luteolin and 7,3',4'-triOMe luteolin. The 6-oxygenated flavones seen were scutellarein, 6-OMe scutellarein, 6-OH luteolin and 6-OMe luteolin.

Flavonols:

Flavonols were comparatively negligible in this family. They

were observed in only 6 plants. These compounds were found entirely absent in both the subfamilies, Nelsonioideae and Thunbergioideae. The compounds located were quercetin, kaempferol, myricetin, 3'-OMe quercetin and 7-OMe kaempferol. Quercetin and its methoxylated derivative (3'-OMe quercetin) were found in 3 plants each. Both these compounds were co-occurring in *Dicliptera verticillata* , Kaempferol along with quercetin is seen in *Adhatoda zeylanica* whereas myricetin occurred along with quercetin in *Rungia repens* .

Glycoflavones :

Glycoflavones were found in 17% of the plants screened. The glycoflavones, identified include vitexin, isovitexin, 4'-OMe vitexin, 6-OMe vitexin and 7-OMe vitexin. Vitexin and isovitexin were the major compounds found in ten plants, whereas 4'-OMe vitexin was located in four plants. The rest of the two i.e. 6-OMe vitexin and 7-OMe vitexin were rare compounds found in one plant each. These compounds were found co-occurring with flavones and flavonols.

Proanthocyanidins :

The single occurrence of proanthocyanidins in the family was in *Elytraria crenata* belonging to the subfamily Nelsonioideae.

Phenolic acids:

Of the 19 phenolic acids obtained, fourteen were benzoic acids and five, cinnamic acids. Benzoic acids include salicylic,

p-OH benzoic, *o*-pyrocatechuic, gentisic, protocatechuic, a-resorcylic, 2-OH, 4-OCH_3-benzoic, 2-OH, 5-OCH_3 benzoic, vanillic, syringic, 3-OH, 4-OCH_3 benzoic, 3-OH, 5-OCH_3 benzoic, phloretic and melilotic acids and the five cinnamic acids were caffeic, *o*-coumaric, *p*- coumaric, ferulic and sinapic acids. Vanillic and syringic acids were the two prominent benzoic acids which occurred in the family. They were found to be present in all the three subfamilies screened. *p*-OH Benzoic acid had more than 55% frequency of distribution, whereas gentisic and melilotic acids were located in more than 30% of the plants studied. Of the five cinnamic acids identified, *p*-coumaric and ferulic acids were present in 24% and 26% of the plants respectively, showing major occurrences in the family. *p*-Coumaric acid found to be present only in the subfamily Acanthoideae. The rare phenolic acids of the family were o-pyrocatechuic, 2-OH, 5-OCH_3 benzoic, 3-OH, 5-OCH_3 benzoic, phloretic and sinapic acids.

Iridoids :

Aucubins were the iridoids located in three plants *viz.* *Staurogyne glutinosa*, *Barleria prionitis* and *Acanthus ilicifolius*.

Alkaloids :

Alkaloids were detected in various parts of 19 plants . Both the subfamilies Nelsonioideae and Acanthoideae possessed them whereas Thunbergioideae were devoid of these compounds.

Subfamily Nelsonioideae :

This subfamily was represented by four plants. They were *Elytraria crenata* , *Nelsonia campestris* , *Nelsonia canescense* and *Staurogyne glutinosa* . All the four plants contained 6-deoxygenated flavones. A glycoflavone, vitexin was located in *Elytraria crenata*. 6-Oxyflavones were found to be absent in this subfamily. *Staurogyne glutinosa* contained aucubins and *Elytraria crenata* contained proanthocyanidins. The later plant gave a positive test for alkaloids. High concentrations of alkaloids were found to be present in roots and leaves. No other plant from the subfamily Nelsonioideae showed the presence of alkaloids.

Subfamily Thunbergioideae :

The 6 species of the genus *Thunbergia* screened for their various chemical components were *Thunbergia alata* , *Thunbergia coccinea* , *Thunbergia erecta* , *Thunbergia Laevis* , *Thunbergia grandiflora* and *Thunbergia mysorensis* . The flavonoids present were in the form of flavones and glycoflavones. The flavones present in three plants, *Thunbergia alata* , *T.coceinea* and *T.erecta* were the derivatives of apigenin. The other three plants were devoid of flavones. *Thunbergia alata* and *T.coccinea* were containing 4'-OCH_3 apigenin, whereas *T.erecta* contained 7-OCH_3 apigenin.

The glycoflavones present were vitexin and isovitexin located in *T.erecta* , *T.grandiflora* , *T.Laevis* and *T.mysorensis* and were found to be absent in *T.alata* and *T.coccinea*. These

plants were devoid of flavonols or proanthocyanidins. Altogether 8 phenolic acids were found to be distributed in Thunbergioideae. Gentisic acid and syringic acids were present in all the plants screened, while only *T.Laevis* showed the absence of syringic acid. *p*-OH Benzoic acid, ferulic and vanillic acids were found only in *T.alata* and *T.coccinea* Protocatechuic acid was found to be absent in *T.coccinea* only. 2-OH, 4-OCH_3 Benzoic acid was found in *T.grandiflora* , *T.coccinea* and *T.mysorensis* whereas 3-OH, 4-OCH_3 benzoic acid was present in *T.erecta* and *T.mysorensis* .

This taxon, the subfamily Thunbergioideae, do not possess the characteristic compounds of the Acanthaceae, **i.e.** the 6-oxyflavones, aucubins and proanthocyanidins and was thus distinct from the later.

Subfamily Acanthoideae :

Most of the tribes of the subfamily Acanthoideae is represented by at least one plant in the present study. Among the 89 plants studied in the subfamily, 47 plants contained 6-deoxygenated flavones and 23 plants contained 6-oxygenated flavones. Glycoflavones were found in 10 plants only. Six plants contained flavonols and 2 plants contained iridoids (mainly aucubins) and proanthocyanidins were found absent in Acanthoideae. The anthocyanidins were found present only in the tribe Pseuderanthemeae. In 10 plants, 6-deoxyflavones occurred together with 6-oxyflavones. Most of the plants with 6-deoxyflavones and glycoflavones belonged to the tribes Hygrophileae, Acantheae, Odontoneminae and Andrographideae. The

two tribes, Acantheae and Odontoneminae, showed the co-occurrence of 6- deoxyflavones and flavonols in various plants, whereas the tribe Justicieae showed their co-occurrence in *Adhatoda zeylanica* . 6-Oxyflavones and glycoflavones co-occurred in different plants of the tribes Hygrophileae, Odontoneminae and Justicieae. Flavonols and glycoflavones occurred together in *Adhatoda zeylanica* of the tribe Justicieae. Thus, *Adhatoda zeylanica* contained 3 different types of compounds 6-deoxyflavones, glycoflavones and flavonols. Iridoids were found co-occurring with 6-deoxyflavones in *Acanthus ilicifolius* (tribe Acantheae) and with 6-oxyflavones in *Barleria prionitis* (tribe Barlerieae).

The phenolic acids were distributed abundantly in the subfamily Acanthoideae. The tribe Petalidieae did not show the presence of benzoic acids whereas tribe Trichanthereae did not contain cinnamic acids. The plants from the tribes Acantheae, Odontoneminae and Justicieae were containing the flavonols and phenolic acids together whereas glycoflavones co-occurred with phenolic acids in the tribes Hygrophileae, Acantheae, Andrographideae, Odontoneminae and Justicieae.

Of the 18 plants with alkaloids 4 were from the tribes Justicieae and Odontoneminae each, 3 were from the tribe Andrographideae, 2 were from Barlerieae and one each from the tribes Trichanthereae, Strobilantheae, Ruellieae, Acantheae and Asystasieae.

On the whole, the presence of 6-deoxyflavones, 6-oxyflavones, glycoflavones,alkaloids and phenolic acids was more

in this subfamily Acanthoideae. Tribes Ruellieae and Barlerieae were rich in 6-deoxyflavones. In comparison to the other tribes of the subfamily Acanthoideae, Odontonemiae and Justicieae were rich in glycoflavones. More over, flavonols detected from these two tribes form a major part of their occurrence in the family Acanthaceae.

Tribe Trichanthereae :

Sancheria nobilis var. *glaucophylla* was the sole representative studied in this tribe. The plant possessed, a single flavonoid, 6-OMe scutellarein, a 6-oxygenated flavone. It also contained vanillic acid and syringic acid but was devoid of cinnamic acids. Alkaloids were present in the plant but in very low concentrations. Iridoids, proanthocyanidins and saponins were found to be absent.

Tribe Hygrophileae :

Three species of *Hygrophila* viz. *H.auriculata*, *H.quadrivalvis* , *H.serpyllum*, *Asteracantha longifolia* and one species of *Hemiadelphis* i.e. *H.polysperma* , were studied in this tribe. The plants showed all the 3 groups of flavonoids. *Hygrophila auriculata* contained apigenin and acacetin, *A.longifolia* contained apigenin and vitexin and isovitexin (glycoflavones) whereas *H.quadrivalvis* contained scutellarein and 6-OMe luteolin (6-oxygenated flavones). In *H.serpyllum* , only one flavonoid compound was seen in the form of scutellarein. *p*-OH Benzoic, gentisic, protocatechuic, 2-OH, 4-OCH_3 benzoic, vanillic, syringic, 3-OH, 4-OCH_3 benzoic,

melilotic, *p*-coumaric, *o*-coumaric, ferulic and sinapic acids were the phenolic acids observed in these plants. The plants were devoid of flavonols, iridoids, saponins and alkaloids.

Tribe Petalidieae :

This tribe was represented by the plant *Petalidium barlerioides*. This plant showed the presence of single flavonoid type i.e. 6-oxygenated flavone, in the form of scutellarein. The plant was devoid of iridoids, alkaloids, saponins and phenolic acids.

Tribe Strobilantheae :

Carvia (1), *Gantelbua* (1), *Goldfusia* (1), *Nilgirianthus* (2), *Thelepaepale*(1), *Hemigraphis* (3) and *Strobilanthus* (2) were the genera studied in this tribe. Of the 11 plants studied, 9 contained 6-deoxyflavones and in four plants they were accompanied by 6-oxygenated flavones. Major 6-deoxyflavone found was acacetin whereas major 6-oxyflavone found was 6-OMe scutellarein. *Carvia callosa* and *Thelepaepale ixiocephala* did not contain 6-deoxyflavones but contained 6-oxyflavones. *Nilgirianthus warreensis* contained alkaloids in a very low concentration and in the rest of the members of the tribe, they were absent. Saponins and iridoids were found to be absent in this tribe. Caffeic acid which was otherwise absent in the tribe was noticed in *Nilgirianthus warreensis* . Similarly, *o*-coumaric acid was found in *Strobilanthus wightianus* . The plants were either devoid of cinnamic acids or when present, were represented by lesser components whereas benzoic acids were found to be very common in this tribe.

Tribe Ruellieae :

Daedalacanthus (1), *Eranthemum* (3) and *Ruellia* (7) were the three genera analyzed from this tribe. Of the twelve plants studied, nine contained 6-deoxyflavones and three 6-oxygenated flavones . All the three plants containing 6-oxygenated flavones also possessed 6-deoxyflavones. *Ruellia alba* and *R.tuberosa* were containing similar flavonoids except for the scutellarein derivatives i.e. *R. alba* contained 6-OMe scutellarein and *R. tuberosa* contained scutellarein. *Eranthemum nervosum* and *E. purpurescence* contained a single, similar flavonoid compound in the form of acacetin whereas *Ruellia baikeii* and *R. colorata* contained two similar flavonoid compound in the form of apigenin and acacetin. *Eranthemum roseum* showed the rare compound 7,3',4'-triOMe luteolin whereas *E. roseum* showing 7,4'-diOMe luteolin was the unique incidence in the tribe. None of these plants contained glycoflavones, flavonols, proanthocyanidins, iridoids or saponins. In its phenolic acid distribution, the tribe was rich in benzoic acids showing prominent occurrence of *p*-OH Benzoic, vanillic, syringic and melilotic acids. Cinnamic acids were found in the form of *p*-coumaric acid and a single occurrence of *o*-coumaric acid.

Tribe Barlerieae :

This tribe was represented by 13 plants belonging to three genera i.e. *Barleria* (8), *Lepidagathis* (3) and *Neuracanthus* (2). Of these, seven contained 6-deoxygenated flavones. Alongwith acacetin, the major flavone, luteolin and 7-OMe luteolin were found present in *Barleria cristata* whereas apigenin and 3'-OMe

luteolin co-occurred in *Lepidagathis bandraensis* Blatter. In *B.prattensis* , luteolin was present. In a single plant i.e. *Barleria strigosa* var. *terminalis* , a single 6-deoxyflavone occurred in the form of 7,3',4'-triOMe luteolin showing its unique occurrence in the tribe. Rest of the plants contained apigenin or acacetin. In *Lepidagathis cristata* and *L. cuspidata* they co-occurred with 6-oxygenated flavones. Apart from these two plants, 6-oxyflavones such as scutellarein or 6-OMe scutellarein were present in three more plants as major compounds. In *Neuracanthus sphaerostachyus* , scutellarein and 6-OH luteolin co-occurred . Glycoflavones and flavonols were found to be absent in the tribe. Except for *Barleria prionitis* , all the other plants did not show the presence of the iridoids. *Barleria prionitis* also contained alkaloids in low concentration as compared to *Neuracanthus sphaerostachyus* which contained higher concentration of alkaloids. The members of this tribe were also devoid of saponins. Benzoic acids were found to be present in all the plants screened. The prominent benzoic acids were *p*-OH benzoic, vanillic, syringic and melilotic acids whereas protocatechuic, 2-OH, 4-OCH_3 benzoic and 2-OH, 5-OCH_3 benzoic acids were rare in occurrence. Cinnamic acids were represented by both ortho- and para coumaric acids in seven plants of the tribe.

Tribe Acantheae :

Of the three genera analyzed, *Acanthus* and *Crossandra* were represented by only a single species each, whereas *Blepharis*, the third genus was represented by five species. All these plants were lacking the 6-oxygenated flavones whereas 4 plants

were found to have 6-deoxyflavones. Apigenin and acacetin were the major 6-deoxyflavones in the tribe. Along with these two compounds, 3'-OMe luteolin was observed in *Acanthus ilicifolius*. This plant was found to contain iridoids also. In *Blepharis madaraspatensis* , 7-OMe apigenin and 7-OMe luteolin co-occurred with vitexin and iso-vitexin, the glycoflavones. Unique occurrence of the flavonol, 3'-OMe quercetin observed in *Blepharis molluginifolia* . This plant showed the presence of alkaloids in low concentration. The tribe showed the presence of *p*-OH benzoic, vanillic and syringic acids as major benzoic acids. Vanillic acid was not observed in *Blepharis repens* where as syringic acid was found absent in *B. asperrima* and *B.linearifolia* The cinnamic acids identified were *p*-coumaric acid in *Acanthus ilicifolius* and *Crossandra undulaefolia* ; caffeic acid in *Blepharis molluginifolia* ; ferulic acid in *B. madaraspatensis* and *B. molluginifolia* and sinapic acid in *Acanthus ilicifolius*.

Tribe Aphelandreae :

Aphelandra tetragona was the sole representative studied in this tribe. This plant a single flavonoid acacetin . It also contained *p*-OH benzoic, vanillic, syringic and melilotic acids as benzoic acids co-occurring with ferulic acid which is a cinnamic acid. Iridoids, proanthocyanidins, saponins and alkaloids were found absent in the plant.

Tribe Andrographideae :

This tribe was represented by 6 plants. These plants showed

two groups of flavonoids i.e. 6-deoxygenated flavones and glycoflavones. The plant, *Indonessiella echioides* contained echioidin whereas *Andrographis paniculata* was having acacetin along with echioidin. *Bremekampia neilgherryensis* contained apigenin and 4'-OMe vixetin. *Haplanthodes verticillaris* was showing a single glycoflavone, 4-OMe vixetin. The 6-oxygenated flavones and flavanols were found absent in all the plants screened. *Andrographis serpyllifolia* and *Phlogacanthus thassiflora* showed negligible amount of flavonoids. The presence of alkaloids was also a prominent feature of the tribe with *Andrographis paniculata*, *Andrographis serpyllifolia* and *Indonessiella echioides* containing them. Saponins and iridoids were not observed in this tribe. The phenolic acids of both the types i.e. benzoic acids and cinnamic acids were seen. In *Andrographis serpyllifolia* , *Bremekampia neilgherryensis* and *Phlogacanthus thassiflora* they occurred together. The cinnamic acids were represented by *p*-coumaric and ferulic acids. All the plants contained *p*-OH benzoic, vanillic and syringic acids as major benzoic acids along with others except in *Haplanthodes verticillaris* where the syringic acid was found absent. Out of the total 99 plants screened phloretic acid was seen only in *Bremekampia neilgherryensis* .

Tribe Asystasieae :

Three species of the genera *Asystasia* were screened in this tribe. None of the plants contained 6-oxygenated flavones, glycoflavones, flavonols, iridoids and saponins. The 6-deoxygenated flavones and phenolic acids were found to be present in the tribe. *Asystasia gangetia* was containing

apigenin, 7-OMe apigenin and 3'-OMe luteolin whereas *A. travancoria* possessed acacetin. The tribe Asystasieae showed very few phenolic acids. *A.gangetia* showed gentisic, vanillic and syringic acids co-occurring with caffeic acid. *A. travancoria* showed only two benzoic acids i.e. *p*-OH Benzoic and vanillic acids and *A. dalzelliana* was having only vanillic acid. *A. dalzelliana* gave positive test for alkaloids.

Tribe Graptophylleae :

This tribe is represented by two species of the genus *Graptophyllum* and a species of the genus *Pachystachys*. The flavonoids could not be identified in this tribe due to the trace amount of these compound in the plants. All the three plants showed both the types of phenolic acids. The genus *Graptophyllum* showed the presence of gentisic, vanillic, syringic and melilotic acid while *G. pictum* differed from the other two species, in having protocatechuic acid. The protocatechuic acid was replaced by *p*-OH benzoic acid in *Pachystachys lutea*. The cinnamic acids of genus *Graptophyllum* was *p*-coumaric acid and in *Pachystachys lutea* they were was represented by caffeic and ferulic acids. The iridoids, alkaloids and saponins were found to be absent in the plants screened.

Tribe Pseuderanthemeae :

Of the four species of *Pseuderanthemum* screened, three contained 6-deoxyflavones. Acacetin was found to be present in *P.atropurpureum* var. *variegatum* and *P. reticulum* whereas *P.sinuatum* was found to have luteolin. But *P.atropurpureum*

lacked any kind of flavonoids. These plants possessed anthocyanins such as cyanidin and delphinidin. All the plants contained both, benzoic and cinnamic acids. *P.atropurpureum* and *P.atropurpureum* var. *variegatum* contained *p*-OH benzoic, vanillic, syringic and melilotic acids along with *p*-coumaric and ferulic acids but later differed in having additional acids **i.e.** gentisic and protocatechuic acids. *P.reticulum* contained *p*-OH benzoic, protocatechuic, vanillic, syringic, *p*-coumaric and ferulic acids whereas *P.sinuatum* had gentisic, vanillic, syringic and ferulic acids. Iridoids, saponins and alkaloids were found to be absent from this tribe.

Tribe Odontonemeae :

This tribe was represented by the genera *Dicliptera* (2), *Rhinacanthus* (2), *Rungia* (2), *Ecbolium* (1) and *Peristrophe* (1). This tribe showed all the four types of flavonoids **i.e.** 6-deoxygenated flavones, 6-oxygenated flavones, flavonols and glycoflavones. 6-OMe scutellarein and 6-oxyflavone were found to be present only in *Rhinacanthus nasutus*. The 6-deoxyflavone, acacetin, was noticed in *Dicliptera roxburghiana*. Acacetin, apigenin, 3'-OMe luteolin and 7,4'-diOMe apigenin were the flavones of *Ecbolium linneanum*. This plant contained glycoflavones, 7-OMe vitexin, and 4'-OMe vitexin. *Dicliptera verticillata* possessed quercetin and 3'-OMe quercetin whereas *Rungia repens* contained quercetin and myricetin. But *Rhinacanthus communis* showed only 3'-OMe quercetin. Alkaloids were present in 50% of the plants, screened in the tribe. *Dicliptera roxburghiana* and *Peristrophe bicalyculata* showed low concentration of alkaloids as compared to *Rungia pectinata* and

Ecbolium linneanum. The phenolic acids were found variously distributed in the tribe, showing acids as major benzoic acids and ferulic acid as major cinnamic acid.

Tribe Justicieae :

The genera studied in this tribe were *Adhatoda* (1), *Beloperone* (2), *Jacobinia* (2) and *Justicia* (10). These plants were showing various flavonoids, phenolic acids and alkaloids. Acacetin was seen in four plants i.e. *Adhatoda zeylanica* , *Jacobinia boliviensis* , *Justicia micrantha* and *Justicia gendarussa*. The sole 6-oxyflavone, of the tribe, 6-OMe scutellarein, was noticed in *Jacobinia cornea*, *Justicia micrantha* and *Justicia glabra* . *Adhatoda zeylanica* was also found to have two different flavanols Kaempferol and quercetin along with the glycoflavone, vitexin. *Justicia betonica* was another plant showing the presence of, a flavonol, 7-OMe kaempferol. Kaempferol and 7-OMe kaempferol were found only in this tribe of the family Acanthaceae. *Jacobinia boliviensis* is found to have 4'-OMe vitexin as glycoflavone. *Rostellularia Japonica* contained 6-OMe vitexin but *J. tranquiberensis* showed the presence of vitexin and iso-vitexin. All the plants of the tribe screened showed abundant phenolic acids except *Justicia neesii* and *Justicia procumbens* var.*simplex* which were lacking cinnamic acids. *Rostellularia Japonica* and *J. tranquiberensis* gave a positive test for alkaloids. Saponins, iridoids and proanthocyanidins were found to be absent from this tribe.

CLADISTICS :

The cladogram in the form of Wagner tree is presented in Fig.1 to 4 and the dendrogram derived from the cladogram is given in Fig.5. The 99 plants screened fall in to 4 groups. However, none of these groups fall into any taxon prescribed by the earlier taxonomists. A closer look on the tree reveals that a number of plants grouped in various taxa occupy the same clades. It is also true that some of the taxa which are considered closer lie in different branches. Since the detailed analysis of the tree would produce more questions from the traditional taxonomist it is not presented here.

TABLE 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Subfamily																									
Nelsonioideae																									
Elytraria crenata Vahl.		+	+																		+			+	
Nelsonia campestris Br.		+				+		+																	
Nelsonia canescense (Lamk.) Spreng.						+																			
Staurogyne glutinosa Kuntze.		+	+																						+
Subfamily																									
Thunbergioideae																									
Thunbergia alata Bojer.			+																						
Thunbergia coccinea Wall.			+																						
Thunbergia erecta T.Anders.				+																+					
Thunbergia laevis Nees.																				+					
Thunbergia grandiflora Roxb.																				+					
Thunbergia mysorensis T.Anders.																				+					
Subfamily																									
Acanthoideae																									
Tribe Trichanthereae																									
Sanchezia nobilis var. glaucophylla Hook.													+												

CONTINUED....

Tribe Hygrophileae																												
Asteracantha longifolia Nees.		+		+																			+					
Hemiadelphis polysperma Nees.																												
Hygrophila auriculata Heine		+		+																			+					
Hygrophila quadrivalvis Nees.													+				+											
Hygrophila serpyllum T.Anders.													+															
Tribe Petalidieae																												
Petalidium barlerioides Nees.													+															
Tribe Strobilantheae																												
Gantelbua urens Bremek.				+																								
Goldfusia dalhousiana Nees.			+										+															
Hemigraphis elegans var.crenata Clarke.			+										+															
Hemigraphis hirta T.Anders.	+																											
Hemigraphis latebrosa var. heyneana Bra.			+																									
Nilgirianthus warreensis (Dalz.) Bramek.			+										+															
Carvia callosa Nees.													+															
Nilgirianthus heyneanus var Neesii Bremek.			+										+															
Strobilanthus scaber Nees.	+		+																									

CONTINUED....

Strobilanthus wightianus Nees.										+																				
Thelepaepale ixiocephala (Benth) Bremek.														+																
Tribe Ruellieae																														
Daedalacanthus nervosus T. Anders.																														
Ruellia longifolia T. Anders.		+																												
Eranthemum nervosum (Vahl.) Br.			+																											
Eranthemum purpurescense Nees.			+																											
Eranthemum roseum Br.				+						+		+		+																
Ruellia alba Joshi		+		+		+								+																
Ruellia baikiei Woodr.		+		+																										
Ruellia colorata Wall.		+		+																										
Ruellia patula Jacq.																														
Ruellia prostrata Lamk.																														
Ruellia tuberosa Linn.		+		+		+							+																	
Tribe Barlerieae																														
Barleria cristata Linn.			+				+		+																					
Barleria grandiflora Dalz.													+		+															
Barleria Lawii T.Anders.																														

CONTINUED....

Barleria mysorensis Roth.																														
Barleria prattensis Sant.								+																						
Barleria prionitis Linn.														+															+	
Barleria strigosa Willd.			+																											
Barleria strigosa var. terminalis															+															
Lepidagathis bandraensis Blatter.			+							+																				
Lepidagathis cristata Willd.				+											+															
Lepidagathis cuspidata Nees.			+											+																
Neuracanthus sphaerostachyus Dalz.													+		+															
Neuracanthus trinervius Wight.																														
Tribe Acantheae																														
Acanthus ilicifolius Linn.			+		+					+																			+	
Blepharis asperrima Nees.																														
Blepharis linearifolia Pers.																														

CONTINUED....

Asystasia travancoria Bedd.				+																									
Tribe Graptophylleae																													
Graptophyllum pictum (L.) Nees.																													
Graptophyllum pictum var. "tricolor"																													
Pachystachys lutea																													
Tribe Pseuderanthemeae																													
Pseuderanthemum atropurpureum																													
Pseuderanthemum atropurpureum var. "variegatum"				+																									
Pseuderanthemum reticulum				+																									
Pseuderanthemum sinuatum																													
Tribe Odontonemeae																													
Dicliptera roxburghiana Nees.				+																									
Dicliptera verticillata Christens.																													
Peristrophe bicalyculata Nees.																													
Rungia pectinata Nees.				+		+						+		+															

CONTINUED....

Rungia repens Nees.																	+		+						
Ecbolium linneanum Kurz.					+																+		+		
Rhinacanthus communis Nees.																		+							
Rhinacanthus nasutus Kurz.												+													
Tribe Justicieae																									
Adhatoda zeylanica Medic.			+												+		+			+					
Beloperone guttata Brand.																									
Beloperone violacea Planch. and Linden.																									
Jacobinia boliviensis Woodr.			+																		+				
Jacobinia cornea Nichols												+													
Justicia betonica Linn.																+									
Justicia micrantha Heyne			+									+													
Justicia deccusta Roxb.																									
Justicia diffusa Willd.																									
Justicia gendarussa Linn.			+																						
Justicia glabra Koen.												+													
Justicia neesii Ramam.																									
																						+			
Rostellularia Japonica (L.) Nees.																									
Justicia tranquiberensis Linn.																				+					
Justicia trinervia Vahl.																									

TABLE 4

Name of Plants	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Subfamily Nelsoniodeae																			
Elytraria crenata Vahl.	+	+			+		+		+	+									+
Nelsonia campenstris																			
Nelsonia canescense (Lamk) spreng.																			
Staurogyne glutinosa Kuntze.				+					+								+	+	
Subfamily Thunbergioideae																			
Thunbergia alata Bojer.		+		+	+				+	+								+	
Thunbergia coccinea Wall.				+			+		+	+								+	
Thunbergia erecta T.Anders.				+	+					+	+								
Thunbergia laevis Nees.				+	+														
Thunbergia grandiflora Roxb.				+	+		+			+									
Thunbergia mysorensis T.Anders.				+	+		+			+	+								
Subfamily Acanthoideae																			
Tribe Trichantheraeae																			
Sanchezia nobilis var. glaucophylla. Hook.									+	+									
Tribe Hygrophileae																			
Asteracantha longifolia Nees.							+		+	+					+		+		
Hemiadelphis polysperma Nees.																			
Hygrophila auriculata Heyne.							+		+	+				+		+			

CONTINUED....

Hygrophila quadrivalvis Nees.		+		+					+	+				+	+			+	
Hygrophila serpyllum T.Anders.		+		+	+					+	+					+		+	
Tribe Petalidieae																			
Petalidium barlerioides Nees.																			
Tribe Strobilantheae																			
Gantelbua urens Bremek.		+							+					+					
Goldfusia dalhousiana Nees.		+		+	+				+	+								+	
Hemigraphis elegans var. crenata Clarke.		+			+				+	+									
Hemigraphis hirta T.Anders.				+	+				+					+				+	
Hemigraphis latebrosa var. heyneana Bremek		+							+										
Nilgirianthus warreensis (Dalz) Bremek.		+			+				+	+							+		
Carvia callosa Bremek.				+	+				+	+				+					
Niglrianthus heyneanus var. Neesii Bremek.	+			+	+				+	+				+					
Strobilanthus scaber Nees.																			
Strobilanthus wightianus Nees.		+		+					+	+				+		+			
Thelepaepale ixiocephala (Benth.) Bremek.	+	+		+					+	+				+					

CONTINUED....

Tribe Ruellieae																						
Daedalacanthus nervosus T.Anders.		+				+			+	+								+				
Dipteracanthus patulus Var. alba Bhandari.		+								+	+						+					
Ruellia longifolia T. Andeos.		+								+												
Eranthemum nervosum Br.		+								+	+						+					
Eranthemum purpurescense Nees.		+				+				+	+						+					
Eranthemum roseum Br.		+		+						+	+						+	+				
Ruellia alba.					+					+							+					
Ruellia baikiei Woodr.																						
Ruellia colorata Wall.		+								+	+						+					
Ruellia patula Jacq.		+								+	+						+					
Ruellia prostrata Lamk.		+		+						+	+						+					
Ruellia tuberosa Linn.					+					+	+						+					
Tribe Barlerieae.																						
Barleria cristata Linn.		+								+	+						+					
Barleria grandiflora Dalz.	+				+	+				+								+				
Barleria Lawii T.Anders.		+								+	+						+					
Barleria mysorensis Roth.		+								+	+						+		+			
Barleria prattensis Sant.		+		+						+	+						+					
Barleria prionitis Linn.		+							+		+	+						+				

CONTINUED....

Barleria strigosa Willd.		+					+	+								+						
Barleria strigosa var. terminalis (Nees) Clarke.		+							+													
Lepidagathis bandrraersis Blatter.									+		+					+						
Lepidagathis cristata Willd.		+							+		+						+					
Lepidagathis cuspidata Nees.		+					+		+		+		+			+						
Neuracanthus sphaerostachyus Dalz.									+		+					+						
Neuracanthus trinervius Wight.							+				+		+			+						
Tribe Acantheae.																						
Acanthus ilicifolius Linn.				+		+		+			+		+				+		+			+
Blepharis asperrima Nees.		+					+				+											
Blepharis linearifolia Pers.		+					+				+											
Blepharis madaraspatensis (L) Heyne.			+					+			+		+								+	
Blepharis molluginifolia Pers.		+									+		+								+	
Blepharis repens Roth.				+		+						+										
Crossandra undulaefolia Salisb.		+									+		+					+				

CONTINUED....

Tribe Aphelandreae																		
Aphelandra tetragona (Vahl.) Nees.	+		+					+	+				+				+	
Tribe Andrographideae																		
Andrographis paniculata Nees.	+							+	+									
Andrographis serpyllifolia Nees.	+			+				+	+					+				
Bremekampia neilgherryensis sreem.	+				+			+	+	+	+	+					+	
Haplanthus verticillatus Nees.	+							+										
Indonessiella echioides Sreem.	+								+	+								
Phlogacanthus thassiflora Nees.	+		+	+				+	+				+	+			+	
Tribe Asystasieae																		
Asystasia dalzelliana Sant.								+										
Asystasia gangetica T.Anders.			+					+	+								+	
Asystasia travancoria Bedd.	+							+										
Tribe Graptophylleae																		
Graptophyllum pictum (L) Nees.			+	+				+	+				+	+				
Graptophyllum pictum Var. "tricolor".			+					+	+				+	+				
Pachystachys lutea.	+		+	+				+	+							+	+	
Tribe Pseuderanthemeae																		
Pseuderanthemum atropurpureum	+							+	+				+	+			+	
P.atropurpureum Var. "Variegatum"	+		+	+				+	+				+	+			+	

CONTINUED....

Pseuderanthemum reticulum			+			+				+		+						+				+	
Pseurderanthemum sinuatum					+					+		+										+	
Tribe Odontonemeae																							
Dicliptera roxburghiana Nees.										+		+											
Dicliptera verticillata christens.										+													
Ecbolium linneanum Kurtz.			+							+		+						+					
Peristrophe bicalyculata Nees.	+		+				+					+										+	
Rhinacanthus communis Nees.			+		+		+					+										+	
Rhinacanthus nasutus Kurz.					+						+		+					+		+		+	
Rungia pectinata Nees.					+		+		+			+											
Rungia repens Nees.					+		+		+		+		+		+								
Tribe Justicieae																							
Adhatoda zeylanica Medic.			+									+		+					+				
Beloperone guttata Brandg.										+		+											
Beloperone violacea Planch and Linden,										+		+		+					+		+		

CONTINUED....

Jacobinia boliviensis Woodr.									+	+									
Jacobinia cornea Nichols.																			
Justicia betonica Linn.									+	+					+				
Justicia micrantha T. Anders.		+							+	+				+	+			+	
Justicia deccusta Roxb.		+		+					+	+					+			+	
Justicia diffusa Willd.		+							+	+								+	
Justicia gendarussa Linn.					+				+	+				+	+			+	
Justicia glabra Koen.		+		+					+	+				+				+	
Justicia neesii Ramam.						+			+	+									
Rostellularia Japonica (L) Nees.		+	+			+				+	+	+							
Justicia tranquiberensis Linn.		+							+	+				+	+			+	
Justicia trinervia Vahl.		+							+										

Table-3.

FLAVONOIDS :-

1) Echioidin

2) Apigenin

3) 4' - OMe apigenin

4) 7 - OMe apigenin

5) 7,4' - diOMe apigenin

6) Luteolin

7) 7 - OMe luteolin

8) 3' - OMe luteolin

9) 7,4' - diOMe luteolin

10) 7,3',4' - triOMe luteolin

11) Scutellarein

12) 6 - OMe scutellarein

13) 6 - OH luteolin

14) 6 - OMe luteolin

15) Kaempferol

16) 7 - OMe Kaempferol

17) Quercetin

18) 3' - OMe quercetin

19) Myricetin

20) Vitexin and isovitexin

21) 4'- OMe vitexin

22) 6 - OMe vitexin

23) 7 - OMe vitexin

24) Proanthocyanidins

25) Aucubins

PHENOLIC ACIDS : Table - 4

1) Salicylic acid

2) *p* - OH Benzoic acid

3) *o* - Pyrocatechuic acid

4) Gentisic acid

5) Protocatechuic acid

6) *α* - Resorcylic acid

7) 2 - OH, 4 - OCH_3 - Benzoic acid

8) 2 - OH, 5 - OCH_3 - Benzoic acid

9) Vanillic acid

10) Syringic acid

11) 3 - OH, 4 - OCH_3 - Benzoic acid

12) 3 - OH, 5 - OCH_3 - Benzoic acid

13) Phloretic acid

14) Melilotic acid

15) *p* - Coumaric acid

16) *o* - Coumaric acid

17) Caffeic acid

18) Ferulic acid

19) Sinapic acid

Sr. No.	Characters	Plesiomorphic State Score = Ø	Apomorphic State Score = 1
1)	Echioidin	Absent	Present
2)	Apigenin	Absent	Present
3)	4' - OMe apigenin	Absent	Present
4)	7 - OMe apigenin	Absent	Present
5)	7,4' - diOMe apigenin	Absent	Present
6)	Luteolin	Absent	Present
7)	7 - OMe luteolin	Absent	Present
8)	3' - OMe luteolin	Absent	Present
9)	7,4' - diOMe luteolin	Absent	Present
1Ø)	7,3',4' - triOMe luteolin	Absent	Present
11)	Scutellarein	Absent	Present
12)	6 - OMe scutellarein	Absent	Present
13)	6 - OH luteolin	Absent	Present
14)	6 - OMe luteolin	Absent	Present
15)	Kaempferol	Present	Absent
16)	7 - OMe Kaempferol	Present	Absent
17)	Quercetin	Present	Absent
18)	3' - OMe quercetin	Present	Absent
19)	Myricetin	Present	Absent
2Ø)	Vitexin and isovitexin	Present	Absent
21)	4'- OMe vitexin	Present	Absent
22)	6 - OMe vitexin	Present	Absent
23)	7 - OMe vitexin	Present	Absent
24)	Proanthocyanidins	Present	Absent
25)	Aucubins	Absent	Present

26) Salicylic acid	Present	Absent
27) ρ - OH Benzoic acid	Present	Absent
28) ℓ - Pyrocatechuic acid	Present	Absent
29) Gentisic acid	Present	Absent
30) Protocatechuic acid	Present	Absent
31) α - Resorcylic acid	Present	Absent
32) 2 - OH, 4 - OCH_3 - Benzoic acid	Present	Absent
33) 2 - OH, 5 - OCH_3 - Benzoic acid	Present	Absent
34) Vanillic acid	Present	Absent
35) Syringic acid	Present	Absent
36) 3 - OH, 4 - OCH_3 - Benzoic acid	Present	Absent
37) 3 - OH, 5 - OCH_3 - Benzoic acid	Present	Absent
38) Phloretic acid	Present	Absent
39) Melilotic acid	Present	Absent
40) ρ - Coumaric acid	Absent	Present
41) ℓ - Coumaric acid	Absent	Present
42) Caffeic acid	Absent	Present
43) Ferulic acid	Absent	Present
44) Sinapic acid	Absent	Present

TABLE – 5

Name of plants	R	L
Subfamily Nelsoniode:		
Elytraria crenata Vahl.	+++	++
Nelsonia campenstris:		
Nelsonia canescense (Lamk) spreng.		
Staurogyne glutinosa Kuntze.		
Subfamily Thunbergioideae		
Thunbergia alata Bojer.		
Thunbergia coccinea Wall		
Thunbergia erecta T.Anders.		
Thunbergia laevis Nees.		
Thunbergia grandiflora Roxb.		
Thunbergia mysorensis T.Anders.		
Subfamily Acanthoide:		
Tribe Trichanthereae:		
Sanchezia nobilis var. glaucophylla		+
Tribe Hygrophileae		
Asteracantha longifolia Nees.		
Hemiadelphis polysperma Nees.		
Hygrophila auriculata Heyne		
Hygrophila quadrivalvis Nees.		
Hygrophila serpyllum T.Anders.		

CONTINUED....

Tribe Petalidieae			
Petalidium barlerioides Nees.			
Tribe Strobilantheae			
Gantelbua urens Bremek.			
Goldfusia dalhousiana Nees.			
Hemigraphis elegans var. crenata Clarke.			
Hemigraphis hirta T.Anders.			
Hemigraphis latebrosa var. heyneana Bremek			
Nilgiridnthus warreensis (Dalz) Bremek.			
Carvia callosa Bremek.			
Nilgirianthus heyneanus Var. Neesii Bremek.			
Strobilanthus scaber Nees.			
Strobilanthus wightianus Nees.			
Thelepaepale ixiocephala (Benth.) Bremek.			
Tribe Ruellieae			
Daedalacanthus nervosus T.Anders.			
Dipteracanthus patulus Var. alba Bhandari.			
Ruellia longifolia T.Anders.			
Eranthemum nervosum Br.			
Eranthemum purpurescense Nees.			

CONTINUED....

Eranthemum roseum Br.			
Ruellia alba Joshi		++	
Ruellia baikiei Woodr.			
Ruellia colorata Wall.			
Ruellia patula Jacq.			
Ruellia prostrata Lamk.			
Ruellia tuberosa Linn.		++	
Tribe Barlerieae.			
Barleria cristata Linn.			
Barleria grandiflora Dalz.			
Barleria Lawii T.Anders.			
Barleria mysorensis Roth.			
Barleria prattensis Sant.			
Barleria prionitis Linn.		+	
Barleria strgosa Willd.			
Barleria strigosa var. terminalis (Nees) Clarke.			
Lepidagathis bandrraersis Blatter.			
Lepidagathis cristata Willd.			
Lepidagathis cuspidata Nees.			
Neuracanthus sphaerostachyus Dalz.		++	
Neuracanthus trinervius Wight.			

CONTINUED....

Tribe Acantheae.			
Acanthus ilicifolius Linn.			
Blepharis asperrima Nees.			
Blepharis linearifolia Pers.			
Blepharis madaraspatensis (L) Heyne.			
Blepharis molluginifolia Pers.			+
Blepharis repens Roth.			
Crossandra undulaefolia Salisb.			
Tribe Aphelandreae			
Aphelandra tetragona (Vahl.) Nees.			
Tribe Andrographidea			
Andrographis paniculata Nees.			+++
Andrographis serpyllifolia Nees.			++
Bremekampia neilgherryensis sreem.			
Haplanthus verticillatus Nees.			
Indonessiella echioides Sreem.			+++
Phlogacanthus thassiflora Nees.			
Tribe Asystasieae			
Asystasia dalzelliana Sant.		+++	++
Asystasia gangetica T.Anders.			

CONTINUED....

Asystasia travancoria Bedd.			
Tribe Graptophylleae			
Graptophyllum pictum (L) Nees.			
Graptophyllum pictum Var. "tricolor".			
Pachystachys lutea.			
Tribe Pseuderanthemeae			
Pseuderanthemum atropurpureum			
P.atropurpureum Var. "Variegatum"			
Pseuderanthemum reticulum			
Pseuderanthemum sinuatum			
Tribe Odontonemeae			
Dicliptera roxburghiana Nees.		+	
Dicliptera verticillata christens.			
Ecbolium linneanum Kurz.		++	
Peristrophe bicalyculata Nees.		+	
Rhinacanthus communis Nees.			
Rhinacanthus nasutus Kurz.			
Rungia pectinata Nees.		++	
Rungia repens Nees.			

CONTINUED....

Tribe Justicieae		
Adhatoda zeylanica Medic,	+++	+++
Beloperone guttata Brand,		
Beloperone violacea Planch and Linden,		
Jacobinia boliviensis Woodr.		
Jacobinia cornea Nichols.		
Justicia betonica Linn.		
Justicia micrantha T. Andeas.		
Justicia deccusta Roxb.		
Justicia diffusa Willd.		
Justicia gendarussa Linn.		
Justicia glabra Koen.		
Justicia neesii Ramam.		
Rostellularia Japonica (L) Nees.		
Justicia tranquiberensis Linn.		+++
Justicia trinervia Vahl.		

PLANTS 1 2 3 4 5

	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44	ADI
RNG.REP.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1 0 1 1 1 1 1 0 1 1 1 0 0 0 1 0 1 0 0 1 1 1 0 0 0 0 0	16
JUS.SIM.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 0 1 1 0 1 0 0 1 1 0 1 1 1 0 0 0 1 1 0 0 0 0 0	17
THN.MYS.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 1 0 1 1 1 0 0 1 0 1 1 0 0 1 1 1 0 0 0 0 0	18
BRM.NLG.	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 0 1 1 0 0 0 0 0 1 0 0 0 1 0	18
RUE.PST.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	19
THN.GRA.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 1 0 1 1 1 0 0 1 0 1 1 0 1 1 1 1 0 0 0 0 0 0	19
ECB.LNM.	0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 0 1 0 1 0 1 1 1 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	19
ELY.CRE.	0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 0 0 0 0 1 1 0 1 0 1 0 0 1 1 1 1 0 0 0 0 1	19
STR.CAL.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 0	19
ERA.PUR.	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 0 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	20
PHL.THS.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 0 1 1 1 1 0 0 1 1 1 0 1 0 0 1 0	20
GRP.PIC.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 0 1 0 0 0 0	20
RUE.PTU.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	20
RHN.CON.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 1 1 1 1 1 1 0 1 0 1 0 0 1 1 1 0 1 1 1 1 1 0 0 0 1 0	20
ADH.ZEY.	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 0 1 1 0 1 1 1 1 0 1 0 1 1 1 1 1 1 1 1 0 0 1 1 1 1 0 0 0 0	20
BAR.PRN.	0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	20
STR.DYR.	0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0 0	20
LEP.CSP.	0 1 0 0 0 0 0 0 0 0 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 0 1 0 0 0 1 1 1 0 0 0 0 0 0	20
NRC.TRN.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 1 1 0 0 1 1 1 0 0 0 0 0 0	20
STR.WGT.	0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 0 1 1 1 1 0 0 1 1 1 0 0 1 0 0 0	20
THE.IXI.	0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	20
THN.ERC.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 0 0 0 0 0	20
HPL.VRT.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 0 0 0	21
THN.FRG.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 1 0 1 1 1 0 0 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0	21
GRP.TRC.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 1 1 1 1 0 0 1 1 1 0 1 0 0 0 0	21
PAC.LUT.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 0 1 1 1 0 0 1 1 1 1 0 0 1 1 0	21
PSD.VAR.	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 0 1 1 1 0 0 1 1 1 0 1 0 0 1 0	21
PER.BIC.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 1 0 1 1 1 1 0 1 1 1 1 0 0 0 1 0	21
THN.ALT.	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 0 1 1 1 0 0 1 1 1 1 0 0 0 1 0	21
BEL.VIL.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 0 0 0 1 1 1 0 0 1 0 0 0	21
BAR.MYS.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 0 0 1 1 1 0 0 1 0 0 0	21
JUS.GLB.	0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 1 0 0 0 0 1 0	21
JUS.NEC.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 0 1 1 0 0 1 1 1 1 0 0 0 0 0	21
HYG.AUR.	0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 1 0 1 1 1 0 1 1 0 1 1 0 1 0 0 1 1 1 0 0 1 0 0 0	21
BLP.ASP.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 0 1 1 0 1 1 1 1 1 0 0 0 0 0	21
BLP.LNR.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 0 1 1 0 1 1 1 1 1 0 0 0 0 0	21
DAE.NRV.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 0 1 1 0 0 1 1 1 1 0 1 0 0 0	21
APH.TRG.	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 1 0 0 0 0 1 0	21
AND.SER.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 0 1 1 1 0 0 1 1 1 1 1 0 0 0 0	21
ERA.NRS.	0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	21
IND.ECH.	1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 1 0 0 1 1 1 0 0 0 0 0	22
GAN.URN.	0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 0 1 1 1 1 0 0 0 0 0 0	22
RUE.CLR.	0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 0 0 1 1 1 0 0 0 0 0 0	22
PSD.ATR.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 1 0 0 1 1 1 0 1 0 0 1 0	22
GOL.DAL.	0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 0 0 1 1 1 0 0 1 1 1 1 0 0 0 1 0	22
HEM.ELE.	0 0 1 0 0 0 0 0 0 0 0 1 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 0 1 1 1 0 0 1 1 1 1 0 0 0 0 0	22
DCL.VRT.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0	22
RNG.PCT.	0 1 0 0 0 0 0 1 1 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 0 0 1 1 1 0 0 1 1 1 0 0 0 0 0	22
HEM.HIR.	0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 0 1 1 1 0 1 1 1 1 0 0 0 1 0	22
BAR.LWI.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 1 0 1 1 1 1 1 1 0 0 1 1 1 1 0 1 0 0 0	22

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
BEL.GUT.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	22
JAC.BOL.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	22
JUS.BET.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	22
JUS.DCS.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	0	0	1	1	1	1	0	0	1	0	22
JUS.DIF.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	1	22
THN.COC.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	0	0	1	1	1	1	0	0	0	1	0	22
JUS.TRQ.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	0	1	0	0	1	0	22
BLP.MBS.	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	0	1	0	0	1	1	1	1	0	0	0	1	0		22
BLP.MLG.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	1	1	0	22
JUS.TRN.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	22
ASY.DAL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	23
ASY.TRV.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	23
BAR.PRI.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	0	1	0	0	1	1	1	1	1	0	0	0	0	0	23
BAR.STR.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1	0	0	0	0	23
DIP.PAT.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	23
SAN.NOB.	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	23
DCL.ROX.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	23
CRO.UND.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	23
PSD.SIN.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0	0	1	0	23
BAR.GRD.	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	1	1	0	1	0	1	1	1	1	0	1	0	0	23
PSD.RET.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	1	1	1	1	1	0	0	1	0	23
AND.PAN.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	23
HYG.SER.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	0	0	1	1	1	0	1	0	1	1	23
NIL.WAR.	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	1	1	1	0	0	1	1	1	1	0	0	1	0	0	23
HEM.LAT.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	23
JUS.GND.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	0	0	1	1	1	0	1	0	0	1	0		23
BAR.TRM.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	23
LEP.BND.	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	23
BAR.CRS.	0	0	1	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	23
NRC.SPR.	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	23
RHN.RPN.	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	1	0	23
HYG.QUD.	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	1	0	23
BLP.REP.	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	0	1	1	1	1	0	1	0	0	0	0	23
DIP.PRS.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	0	0	0	0	0	23
HEM.POL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	24
ERA.ROS.	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	0	0	1	1	1	0	1	0	0	0	0	24
JUS.CRN.	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	1	1	0	1	0	0	1	0	24
LEP.CRS.	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	0	0	24
ACN.ILC.	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	0	0	1	1	1	0	1	0	0	0	1				24
PET.BAR.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	25
JAC.COR	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	25
NEL.CAN.	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	25
ASY.GAN.	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0	1	0	0	25
STR.SCA.	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	26
RUE.BAI.	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	26
STG.GLT.	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0	26
RUE.TUB.	0	1	1	1	0	0	0	0	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	1	1	1	1	0	0	0	0	0	26
RUE.ALB.	0	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0	27
NEL.CAM.	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	27

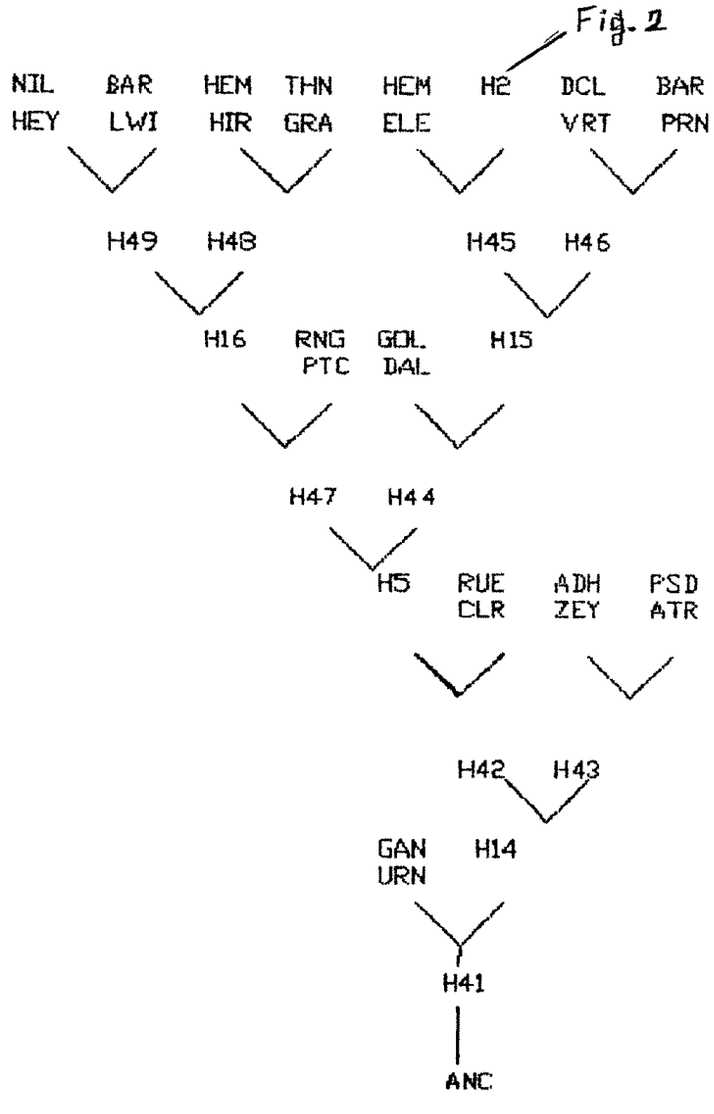
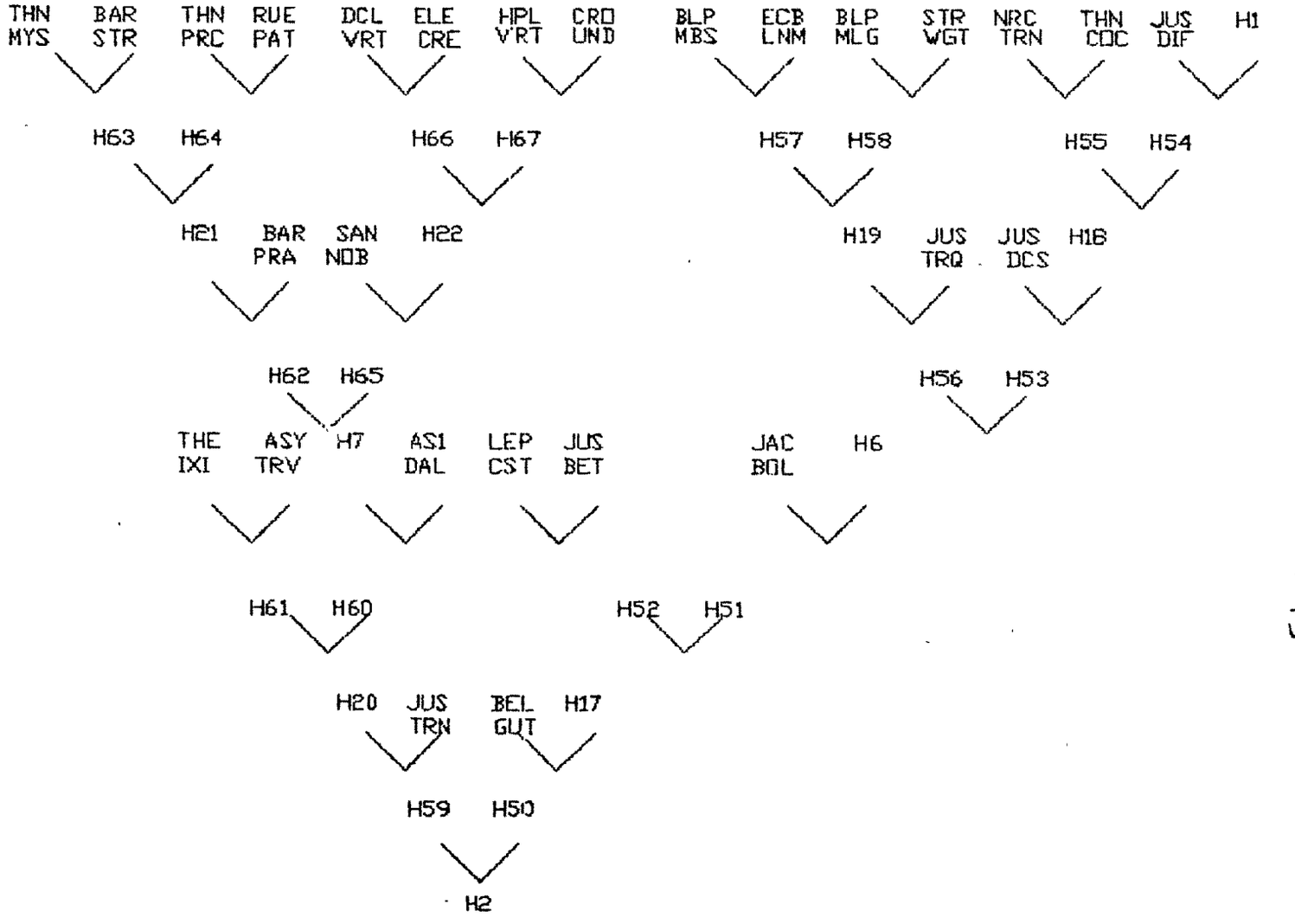


FIG. 1

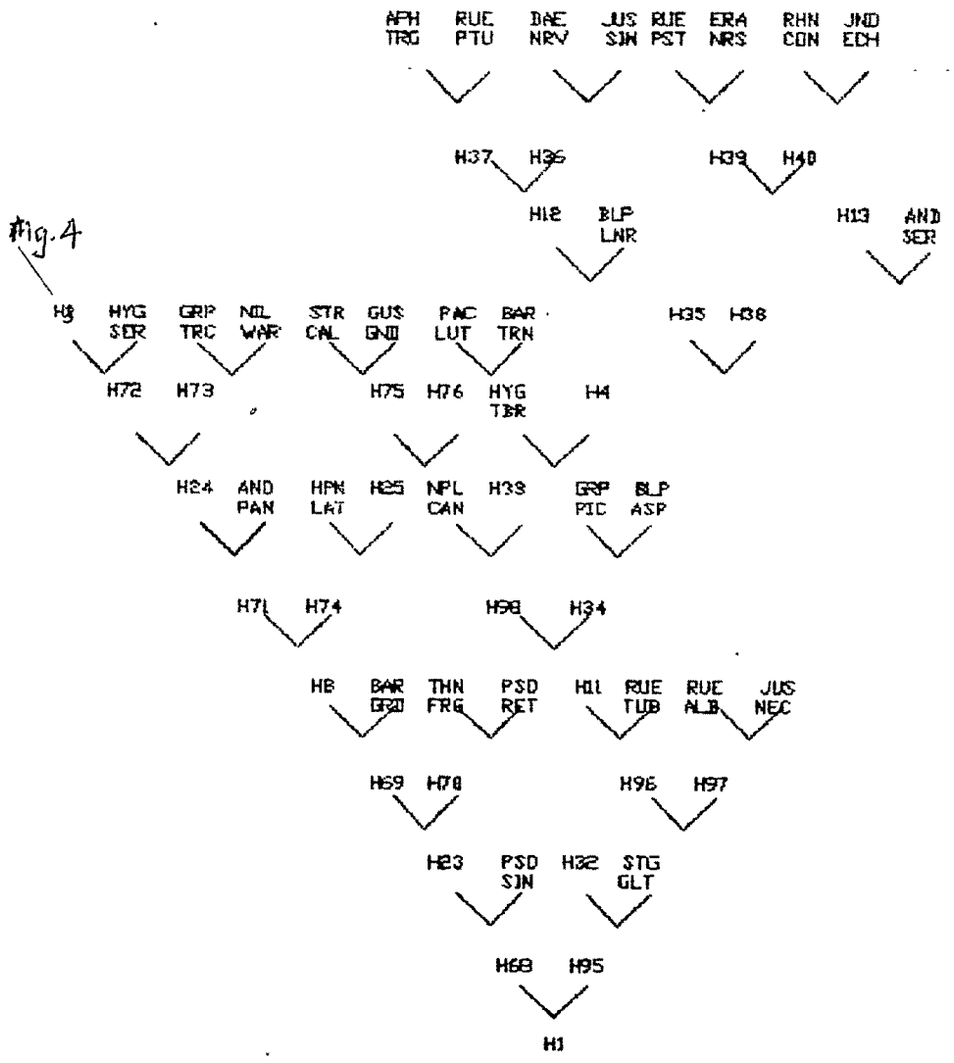
Cladogram

Fig.3



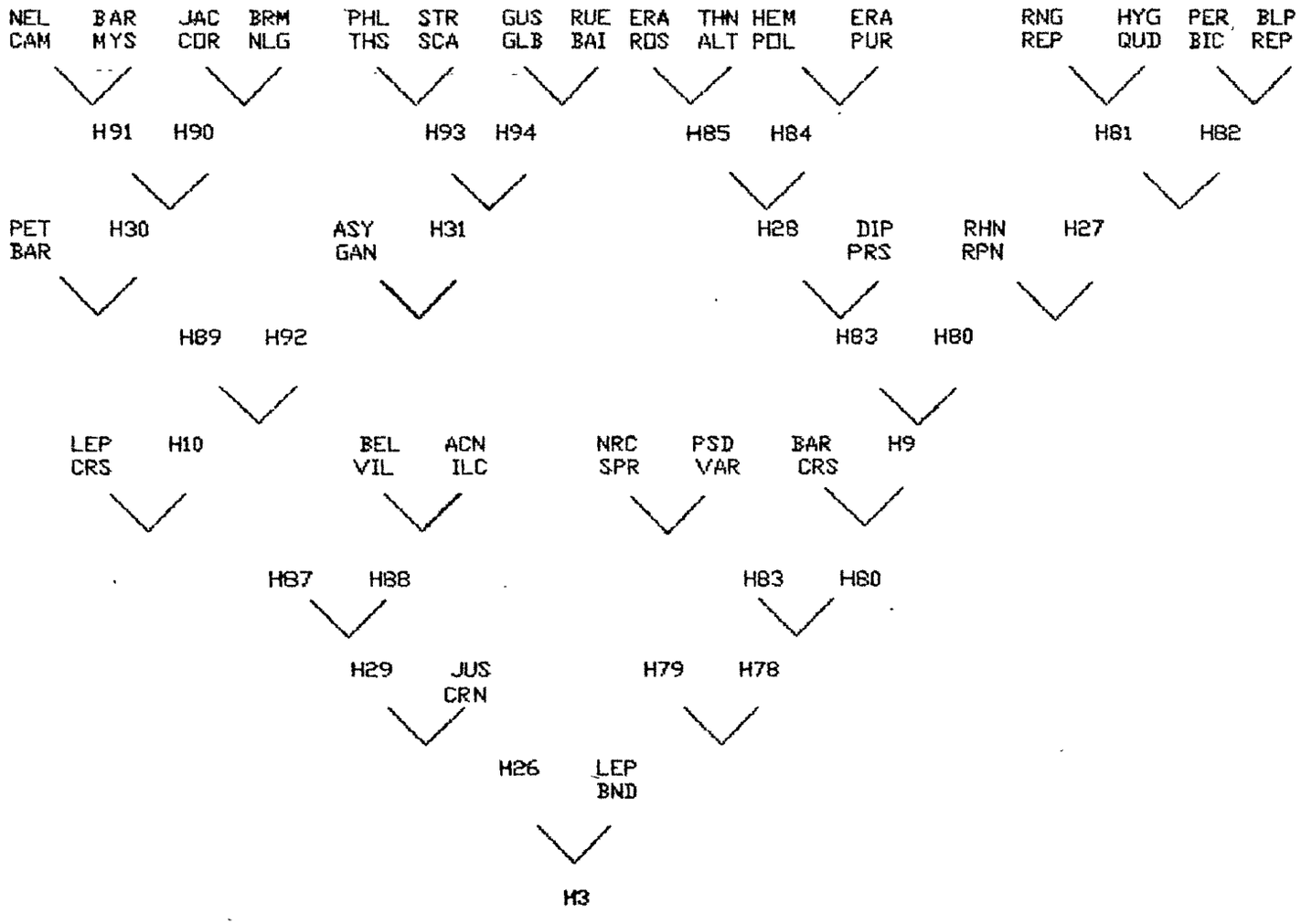
Cladogram

FIG. 2



Cladogram

FIG. 3



Cladogram

FIG. 4