

Autogamy in various species of the genus *Rosa*

Autogamie různých druhů rodu *Rosa*

Dagmar Jičínská

JIČÍNSKÁ D. (1976): Autogamy in various species of the genus *Rosa*. — Preslia, Praha, 48 : 225—229.

Modes of pollination are shown to vary in 23 species belonging to six sections of the genus *Rosa*. Certain species (sections *Caninae*, *Jundzilliae*) are predominantly autogamous, while others (sections *Pimpinellifoliae*, *Gallicanae*, *Cinnamomeae*, *Synstylae*) are partly or completely autosterile (aut-incompatible). It is suggested that these differences are in connection with different types of meiosis.

Botanical Institute, Czechoslovak Academy of Sciences, 252 43 Práhonice, Czechoslovakia.

INTRODUCTION

The variability of the genus *Rosa* caused much taxonomic confusion in the past. It has been realized that one of the causes of the variability is spontaneous hybridization and its consequences. TÄCKHOLM discovered irregular meiosis in the section *Caninae* (TÄCKHOLM 1920, 1922), thus elucidating a great deal of problems previously unanswerable.

From REICHENBACH (1832) who clearly recognized the hybrid character of some taxa, to BOULANGER (1921, 1927) and KELLER (1931), hundreds of hybrids between various species have been described. However, only a small number of them have been verified experimentally. Successful results of experiments may be expected in the future.

Nonetheless, until recently it was impossible to explain the variability of populations, their changes and microevolution within the genus, and to construct an adequate system of classification. Evidence is now available (ERLANSON 1929, 1934, FÄGERLIND 1940, 1942, 1944a, 1944b, 1946, 1948, 1951, GUSTAFSSON 1942, RATHLEF 1937, RATSEK, YARNELL et FLORY 1939, 1941) that only certain combinations in crossing are successful, i.e. normally developing zygote may not arise even when pollen, embryo-sac and gametes are completely viable.

Compatibility and incompatibility (the term "compatibility" describing the possibility of all gametic combinations, "incompatibility" excluding certain gametic combinations even when all gametes are viable) has been studied by the above authors. Incompatibility was studied in crosses between the species of sections *Caninae* and *Cinnamomeae*. It may appear when different individuals of the same taxonomic unit or different taxa are crossed, or when autogamy cannot take place (a case of aut-incompatibility or auto-sterility).

The variation in fertility in different sections of the genus *Rosa* claims attention. The analysis presented in this paper may be of some use for further research.

Tab. 1. — Taxonomic classification of the taxa examined

Subgenus *Rosa*

Sect. 1: *Pimpinellifoliae* DC.

R. pimpinellifolia L. (*R. spinosissima* L.)

Sect. 2: *Gallicanae* DC.

R. gallica L. (*R. austriaca* CRANTZ, *R. pumila* JACQ.)

Sect. 2: *Jundzilliae* CRÉP.

R. jundzillii BESS. (*R. trachyphylla* RAU, *R. marginata* auct. non WALLR.)

Sect. 4: *Caninae* DC.

Subsect. a) *Vestitae* CHRIST

R. pomifera HERRM.

R. tomentosa SM.

Subsect. b) *Rubiginosae* DC.

R. rubiginosa L. (*R. eglanteria* L. nom. ambig.)

R. elliptica TAUSCH (*R. graveolens* GREN., *R. inodora* BOULENG. part. non FRIES)

R. caryophyllacea BESSER non CHRIST

R. zalana WIESB.

Subsect. c) *Eucaninae* CRÉP.

R. canina L. (incl. var. *lutetiana* (LÉM.) BAK., var. *dumalis* BAKER non BECHSTEIN, *R. fallens* DÉS., cv. *inermis* etc.)

R. subcanina (CHR.) DALLA TORRE et SARNTH.

R. vosagiaca DESP. (*R. glauca* VILL. non POUR, *R. dumalis* BECHST. part.)

R. corymbifera BORKH. (*R. dumetorum* THUILL., *R. platyphylla* RAU)

R. vagiana CRÉP. ex SAGORSKI

R. pycnanantha BORB.

Sect. 5: *Cinnamomeae* DC.

R. majalis HERRM. (*R. cinnamomea* L.)

R. pendulina L. (*R. alpina* L.)

R. rugosa THUNBG.

R. Sweginzowii KOEHNE

Sect. 6: *Synstylae* DC.

R. arvensis HUDS. (*R. repens* SCOP., *R. silvestris* HERRM.)

R. multiflora THUNBG. (*R. thunbergii* TRATT.)

R. filipes REHD. et WILS.

R. × *reversa* WALDST. et KIT. (*pimpinellifolia* × *pendulina*)

MATERIAL

The material used in this study belonged to 23 species of the genus *Rosa*. The plants are grown in the rhodological collection of the Botanical Institute, Czechoslovak Academy of Sciences, Průhonice near Prague. All species examined (see Tab. 1) except for *R. rugosa*, *R. Sweginzowii*, *R. multiflora* and *R. filipes* are native in Czechoslovakia. The collection consists mainly of plants transplanted from the field and/or grown from seeds gathered in the field or obtained from botanical gardens. The remaining individuals were transplanted from nurseries. All material was identified by I. Klášterský.

METHODS

Autogamy had to be performed before the buds opened. In the majority of cases whole twigs with 20—30 buds were isolated. Isolation bags (close nylon) were large enough to protect the flowers against the lack of light, overheating or mechanical damage. Bags were kept on the twigs until the hips ripened.

RESULTS

Results of autogamies carried out in 1967—1973 are summarized in Tab. 2 (the number of isolated buds taken as 100 per cent). The figures listed in Tab. 2 show considerable variation especially when sections are considered. Apparently, species of the section *Caninae* give best results, the range of variation being from 41.3% for *R. tomentosa* to 96.0% for *R. corymbifera*. Lower figures for *R. tomentosa* and *R. pomifera* may be due to the small

Tab. 2. — Fertility of self-pollinated plants

Sect.	Species	Chromo- some number	Number of plants	Number of buds	Number of hips	Per cent success- ful
1	<i>R. pimpinellifolia</i>	2n = 28	7	499	74	14.8
2	<i>R. gallica</i>	2n = 28	2	71	8	11.3
3	<i>R. jundzillii</i>	2n = 42	3	289	252	87.2
4	<i>R. pomifera</i>	2n = 28	3	164	74	45.1
	<i>R. tomentosa</i>	2n = 35	1	75	31	41.3
	<i>R. rubiginosa</i>	2n = 35	4	425	384	84.9
	<i>R. elliptica</i>	2n = 35	2	281	242	86.1
	<i>R. caryophyllacea</i>	2n = 35	2	215	194	90.2
	<i>R. zalana</i>	2n = 35	5	290	219	75.5
	<i>R. canina</i>	2n = 35	2	282	234	82.2
	<i>R. subcanina</i>	2n = 35	2	140	126	90.0
	<i>R. vosagiaca</i>	2n = 35	3	253	241	95.3
	<i>R. corymbifera</i>	2n = 35	2	278	267	96.0
	<i>R. vagiana</i>	2n = 35	3	286	224	78.3
	<i>R. pycnanantha</i>	2n = 35	5	332	295	88.9
5	<i>R. pendulina</i>	2n = 28	11	1001	20	2.0
	<i>R. majalis</i>	2n = 28	4	620	53	8.5
	<i>R. Sweginzowii</i>	2n = 42	1	112	6	5.4
	<i>R. rugosa</i>	2n = 14	4	179	0	0
6	<i>R. arvensis</i>	2n = 14	4	338	0	0
	<i>R. multiflora</i>	2n = 14	3	852	0	0
	<i>R. filipes</i>	2n = 14	1	725	0	0
	<i>R. × reversa</i>	2n = 28	3	608	344	56.6

number of plants examined or small number of isolated buds. *R. jundzillii* (section *Jundzilliae*) also showed good fertility, the percentage of ripened hips being about 87.2%. In this case a slightly lower figure (79.1%) was obtained when the percentage of one heptaploid individual (30.0%) was involved. *R. pimpinellifolia* (section *Pimpinellifoliae*) and *R. gallica* (section *Gallicanae*) produced only few ripened hips, on the average about 14.8% in the former and about 11.3% in the latter. Fertility of *R. pimpinellifolia* individuals varied considerably — e.g. the most fertile plant (observed for several years) gave 24.8% of ripened hips while remaining six individuals (observed only for one year) gave nearly 0%.

In the section *Cinnamomeae*, the hip fertility varies over a wide range. *R. rugosa* produced no hips at all although the plants were normally fertile when free-pollinated [the same extreme results were observed in all species of the section *Synstylae* (*R. arvensis*, *R. multiflora*, *R. filipes*) which are highly fertile in nature]. Rather low figures were also obtained in *R. pendulina* (2.0%), *R. Sweginzowii* (5.4%) and *R. majalis* (8.5%) in which species two individuals (probably hybrids) with 65.8% and 75.0% were not taken into account.

R. reversa (a constant hybrid of *R. pimpinellifolia* and *R. pendulina*) gave quite different percentage of hips (56.6%) from both parents.

CONCLUSIONS

It follows from the above results that the species of the genus *Rosa* differ in the mode of pollination. Autogamy prevails in certain species while in others partial or complete autosterility (aut-incompatibility) occurs. Nevertheless, the second group of species, though self-sterile, produces hips when pollen from different individuals of the species is used. Striking difference in the mode of pollination may be observed when the various sections are compared. Species of the sections *Caninae* and *Jundzilliae* are self-pollinated (autogamy) while remaining species of the sections *Pimpinellifoliae*, *Gallianae* and *Cinnamomeae* are partly or completely autosterile. In this case one may speculate about possible connection with different types of meiosis in the species of the sections *Caninae* and *Jundzilliae* where balanced heterogamy (TÄCKHOLM 1920, 1922) is known to occur. The specific type of meiosis and pollination in the latter species indicate their hybrid origin.

SOUHRN

Autogamizací 23 druhů šesti sekcí rodu *Rosa* byly zjištěny rozdíly ve způsobu opylení. U některých druhů převládá samoopylení, u jiných se vyskytuje částečná nebo úplná autosterilita (autoinkompatibilita). Druhy, patřící do sekce *Caninae* a *Jundzilliae*, jsou autogamní, druhy ze zbývajících čtyř sekcí (*Pimpinellifoliae*, *Gallianae*, *Cinnamomeae* a *Synstylae*) jsou částečně nebo úplně autosterilní (autoinkompatibilní). Dále se poukazuje na možnou souvislost odlišného typu sprašování s odlišným typem meioze.

REFERENCES

- BOULANGER G. A. (1929): Sur les hybrides des roses de l'Europe Centrale et Occidentale. — Rev. Quest. Sci. Bruxelles, Louvain, 15 : 251—266.
- ERLANSO E. W. (1929): Cytological conditions and evidences for hybridity in North American roses. — Bot. Gaz., London, 57 : 443—506.
- (1934): Experimental data for a revision of the North American wild roses. — Bot. Gaz., London, 96 : 197—259.
- FAGERLIND F. (1940): Sind die Canina-Rosen agamospermische Bastarden? — Svensk. Bot. Tidskr., Stockholm, 34 : 344—353.
- (1942): Kommt Agamospermie bei den Canina Rosen vor? — Hereditas, Lund, 38 : 224—227.
- (1944a): Kompatibilität und Inkompatibilität in der Gattung Rosa. — Act. Hort. Berg., Stockholm, 13 : 247—302.
- (1944b): Die Zertationverhältnisse bei Rosa. — Svensk. Bot. Tidskr., Stockholm, 38 : 226—228.
- (1946): Pollenkonkurrenz und Bastardierungsschwierigkeiten in der Gattung Rosa. — Svensk. Bot. Tidskr., Stockholm, 40 : 284—292.
- (1948): Compatibility, eu- and pseudo-incompatibility in the genus Rosa. — Act. Hort. Berg., Stockholm 15 : 1—36.
- (1951): Influence of the pollen giver on the production of hips, achenes and seeds in the Canina roses. — Act. Hort. Berg., Stockholm, 16 : 121—168.
- GUSTAFSSON A. (1942): Cross-experiments in the genus Rosa. — Hereditas, Lund, 28 : 235—238.
- KELLER A. (1931): Synopsis Rosarum spontanearum Europae mediae — Zürich.
- RATHLEF H (1937): Die Rosen als Objekt der Züchtung. — Arb. Zentralst. f. Rosenforsch., Sangerhausen, I. Jena.
- RATSEK J. C., S. H. YARNELL et W. S. FLORY (1939): Crossing relations of some diploid species of roses. — Proc. Am. Soc. Hort. Sci., Geneva and New York, 37 : 983—992.
- (1941): Crossing relations of some diploid and polyploid species of roses. — Proc. Am. Soc. Hort. Sci., Geneva and New York, 38 : 637—654.
- REICHENBACH L. (1832): Flora Germanica excursoria.

TÄCKHOLM G. (1920): On the cytology of the genus *Rosa*. — Svensk. Bot. Tidskr., Stockholm, 14 : 300—311.

— (1922): Zytologische Studien über die Gattung *Rosa*. — Act. Hort. Berg., Stockholm, 7 : 97—381.

Received September 16, 1975

Reviewed by E. Daumann

Erratum

In my paper "Diversity of pollination in some *Rosa* species" (Preslia, Praha, 47 : 267—274, 1975), the chromosome number of $2n = 28$ for *Rosa arvensis* R 117 (p. 269) is a misprint for $2n = 14$.