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**Blooming Biology and Flow Value of *Rosa multiflora* Thunb. Shrubs**

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Biologia kwitnienia i wartość pożytkowa krzewów *Rosa multiflora* Thunb.

INTRODUCTION

According to a practical, horticultural taxonomy the species of *Rosa multiflora* Thunb. belongs to section *Synstylae* while with regards to the criteria of use it is placed among a group of park roses. In natural habitats the shrubs of this species grow in China, Japan and Korea. In Europe this wild rose of East Asian origin has been cultivated for approx. 150 years. *Rosa multiflora* plants are very variable so many forms of the species are recognizable. Those shrubs are frost resistant and wind tolerant. They are also disease resistant. Seeds of *Rosa multiflora* can be sown without previous stratification. Seedlings of *Rosa multiflora* are used as stocks in the grafting of rose cultivars. In Poland, besides wild-grown forms, these shrubs are planted in non-cut hedges, in parks and even in small gardens. *Rosa multiflora* is the most attractive as a free-grown shrub. The growth is rank and shrubs are 2.5 m high. The upright, many-flowered corymbs form abundantly on arching branches. Flowers are small, approx. 2 cm in diameter, fragrant and white with bright yellow stamens. A graceful habit as well as abundant flowering cause big attractiveness of *R. multiflora* bushes. Floral nectaries are absent, like in the other roses, so flowers supply bees only with pollen. Lipiński (1982) includes *R. multiflora* among important pollen plants. The biology of pollen production as well as the value of *Rosa multiflora* pollen to bees was not studied until now. Bożek (1988) reported the pollen productivity only in *Rosa rugosa* flowers. Unpublished, one-year's results concerning the process of pollen production in *R. rugosa* flowers are also contained in master's degree dissertations of students of Agricultural Academy in Lublin (Bobrzyńska, 1973;



Basiak 1988). However, Nadłonek (1990), in her master's degree dissertation, compared the quantity and quality of pollen supplied by flowers of 9 rose species. Among others, the first time she determined the pollen efficiency of *R. multiflora*, using Szklanowska's method (1984). She found that the pollen mass per 10 flowers of this species ranged from 16.5 to 18.5 mg. In her investigations the consecutive stages of the shrubs flowering were taken into consideration. Warakomska (1999), analyzing the pollen loads samples originated from Puławy, stated the presence of *Rosa* sp. pollen grains in them.

Distinguishably frequent foraging of *R. multiflora* flowers by honeybees, observed every year, was a cause to start a study on melliferous value of this species. *Rosa multiflora* shrubs are often planted in parks and on lawns in Lublin as ornamental plants.

#### MATERIAL AND METHODS

Six 2.5 m high, non-formed shrubs of *Rosa multiflora* were chosen for investigations. They grew in green areas of the academic campus in Lublin. Shrubs were planted in some distance from each other. Their red-green, long, arching branches reached ground level. The habitat of shrubs was spherical, compact and regular. The crown surface of each bush was approx. 8 m<sup>2</sup>. In the consecutive years of studies, 1997-2000, all observations concerning the flowering process were made on the same shrubs. Also, pollen samples were collected from the same plants every year. The diurnal and seasonal dynamics of flowering as well as foraging flowers by insects were studied with methods recently used in an apicultural botany (Jabłoński and Szkanowska 1997). The quantitative analysis of pollen produced by flowers of each shrub was performed according to Szklanowska's method (1984, 1995). The viability of pollen grains was estimated by testing their stainability with acetocarmine, straight after collecting pollen from anthers. Moreover, the size of pollen grains was determined. Fully expanded grains were measured along both the equatorial and polar axis, in glycerin jelly slides.

#### RESULTS

**Flowering biology and pollen production.** Every year of the study, first flowers in inflorescences of *R. multiflora* started to open in the 3<sup>rd</sup> decade of May. In consecutive years of investigations, the fluctuations in time of flowering termination were approx. 1 week. In 1997, when spring was warm and sunny, shrubs started to bloom on May 25<sup>th</sup>. The opening of flower buds was significantly slowed down by rainfalls at the end of May as well as by a decline in temperature (down to 10°C), which occurred at the beginning of June. The extremely favorable weather conditions in 1998 sped up blooming of shrubs so much that opening of the last flowers finished on June 6<sup>th</sup>. A difference in the length of the flowering process of shrubs between the 1999 and 2000 reached



5 days, but the weather conditions in May 1999 and May 2000 were extremely diverse (Fig.1). In 1999, the drought prior to the start of blooming affected a significant delay in flower buds opening. In 2000, after a few days of heat-wave, with temperatures up to 29 °C, rainfalls and cold nights (3-5 °C) occurred when the peak of flowering started (May 28<sup>th</sup>). Such a sharp change in the weather caused almost full inhibition in flowers opening from May 31<sup>st</sup> until June 2<sup>nd</sup>. After chilly days sunny weather returned. The maximum temperature rose up to 30° C and the shrubs continued flowering normally. In both seasons of studies, the differences in seasonal dynamics of flowers' development were very clear, especially at the stage of full flowering.

In general, during rainy days with high air humidity, the shrubs of *Rosa multiflora* opened a smaller number of flowers. The parting of petals occurred only in the morning, between 4:00h (5:00h) and 6:00h (7:00)h E.E.T. Flowers did not open later during a day, regardless of weather conditions. Independently of flower location on an inflorescence axis as well as exposition of the shrub to the sunshine, the lifespan of a flower was 2 days, on average. All still unwilted petals fell almost at the same time.

The number of stamens in a flower of *R. multiflora* varied and the value ranged from 60 to 100 (Tab.1). It was noticeable that with the termination of shrub flowering the number of stamens per flower decreased. The anthers dehisced in a flower bud stage. No differentiation in order of anthers dehiscence in whorls of stamens was observed. The process ran very quickly. Just after 14:00h not only all stamens turned brown but their anthers dropped as well. Between 9:00h and 11:00h flowers were foraged by honeybees and solitary bees, while earlier in the morning they were visited mainly by bumblebees.

Tab. 1. The numbers of anthers in flower, flowers in inflorescence and flowers per *Rosa multiflora* Thunb. shrubs in years 1997-2000

| Year of study | Anthers in one flower |       | Flowers in one infloresc. |       | Infloresc./1 m <sup>2</sup> surface of crown |        | Flowers in thous. / 1 m <sup>2</sup> surface of crown |      |
|---------------|-----------------------|-------|---------------------------|-------|----------------------------------------------|--------|-------------------------------------------------------|------|
|               | min- max              | mean  | min-max                   | mean  | min-max                                      | mean   | min-max                                               | mean |
| 1997          | 61-73                 | 68.31 | 22-48                     | 32.21 | 60 - 152                                     | 107.02 | 1.3 - 7.3                                             | 3.44 |
| 1998          | 70-103                | 90.42 | 20-57                     | 35.40 | 52 - 172                                     | 103.24 | 1.0 - 9.8                                             | 3.65 |
| 1999          | 66-101                | 81.80 | 25-51                     | 33.42 | 50 - 160                                     | 102.13 | 1.3 - 8.2                                             | 3.41 |
| 2000          | 65-76                 | 71.93 | 20-55                     | 32.70 | 53 - 120                                     | 106.50 | 1.1 - 6.6                                             | 3.48 |
| Average       | 65.5-88.3             | 78.11 | 21.8-2.8                  | 33.43 | 53.8-1.0                                     | 104.72 | 1.20-8.00                                             | 3.50 |

The mean number of flowers per 1 inflorescence (33) as well as the mean numbers of inflorescences and flowers per 1m<sup>2</sup> of crown surface of free-grown shrub (104 and 3.500, respectively) were almost constant in consecutive years of studies.



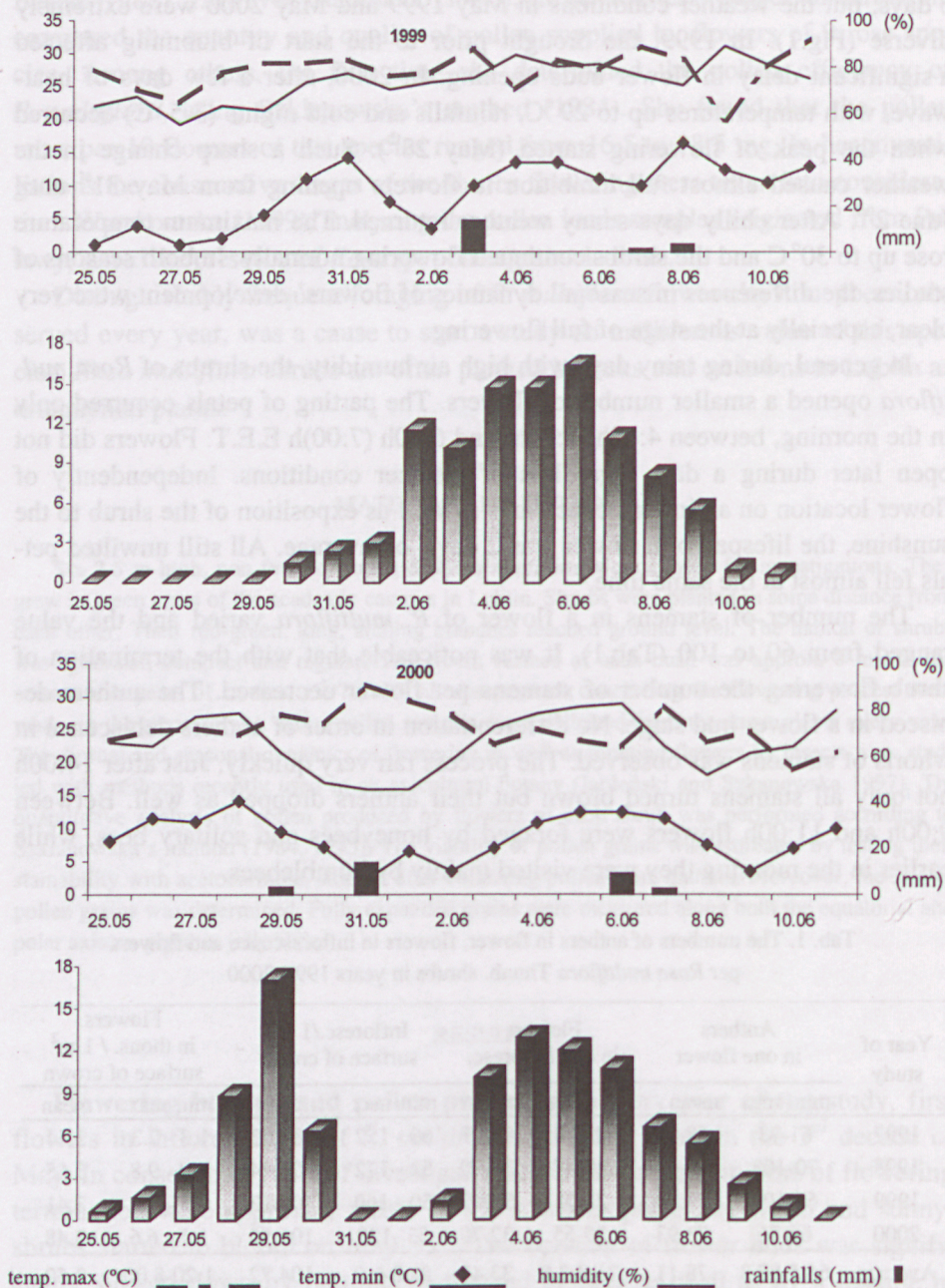


Fig. 1 Seasonal dynamics of blooming of flowers *Rosa multiflora* Thunb. against the background of the weather condition in years 1999-2000

(Bars show the number of blooming flowers per examined inflorescences in consecutive days of flowering period, expressed as a percentage of the total number of flowers)



**Pollen efficiency and features of pollen grains.** The amounts of pollen produced by *R. multiflora* flowers differed in the years of investigations (Tab.2). The biggest variation in the obtained values was stated for the first and the second years of studies. The smallest amount of pollen – 14.0 mg (12.2-14.6 mg) per 10 flowers, on average, was in 1997 when the month prior to flowering was cold, cloudy and rainy. Changeable weather conditions in 1998 decreased the

Tab. 2. Mass of pollen calculated for *Rosa multiflora* Thunb. shrubs for 4 years' research

| Year of study | mg/10 flowers |       | mg / one inflorescence |       | g/1m <sup>2</sup><br>surface<br>of crown | g/shrub* | kg/100**<br>run. m. |
|---------------|---------------|-------|------------------------|-------|------------------------------------------|----------|---------------------|
|               | min-max       | mean  | min-max                | mean  |                                          |          |                     |
| 1997          | 12.2-14.6     | 14.05 | 30.8- 67.2             | 49.61 | 4.82                                     | 42.42    | 2.76                |
| 1998          | 21.0-30.9     | 28.71 | 57.4-163.6             | 97.00 | 10.48                                    | 80.00    | 5.20                |
| 1999          | 17.2-26.3     | 19.85 | 49.8-101.5             | 66.52 | 6.78                                     | 54.04    | 3.54                |
| 2000          | 16.2-19.0     | 18.04 | 36.0- 99.0             | 58.91 | 6.27                                     | 50.14    | 3.28                |
| Average       | 16.65-22.70   | 20.16 | 43.50-107.83           | 68.01 | 7.09                                     | 56.65    | 3.70                |

\* Shrubs with crown surface approx. 8 m<sup>2</sup> and height 2-2.5 m

\*\* Received from the number of 65 shrubs, growing along a 100 running meter avenue

length of all stages of flowering but in this season the pollen efficiency of flowers was the highest throughout all the studied period. Ten flowers produced 28.7 mg (21-31 mg) of pollen, on average. This amount was by 100% bigger than the value in 1997. Moreover, the mean pollen mass supplied by 1 shrub was twice bigger (80g). The higher value of mean pollen mass per 10 flowers was connected not only with more numerous stamens in 1 flower, 90 (70-105), on average. The effect of well-developed anthers and fully mature pollen grains was also observed. The analysis of the mass of 100 anthers confirmed such influences. The anthers were collected randomly just before their dehiscence, directly from flower buds every year of studies (Fig. 2). Both fresh and dried to constant

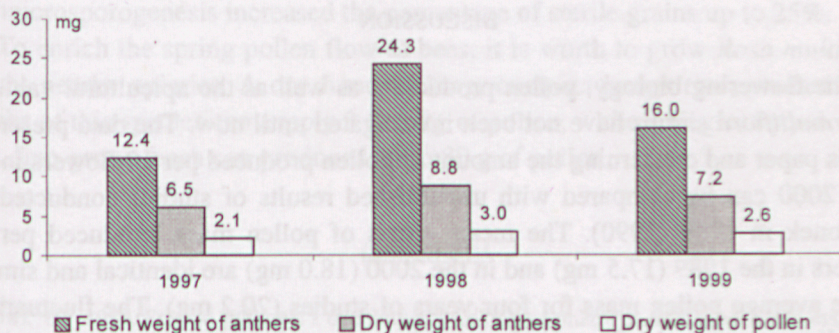


Fig. 2 A comparison of the mass of 100 fresh anthers of *Rosa multiflora* Thunb. and the weight of dry pollen in these anthers in 1997-1999



weight anthers were heavier and contained a larger amount of pure, dry pollen. The years 1999 and 2000 sharply differed in the weather during the flowering of *Rosa multiflora* but in these years the mean amounts of pollen produced per 10 flowers, per 1 inflorescence and per 1 shrub were similar and the values were: 18.0 and 19.9 mg, 58.9 and 66.5 mg and 50-54 g, respectively. In 1999 a longer drought period, prior to flowering of shrubs, delayed that process by 5 days and also adversely affected the viability of pollen grains (Tab.3). The pollen grains

Tab. 3. The viability and dimensions of pollen grains of *Rosa multiflora* Thunb. in years 1997-2000

| Year of study | Viability of pollen in % |       | The length of axis in $\mu\text{m}$ |       |                        |       |
|---------------|--------------------------|-------|-------------------------------------|-------|------------------------|-------|
|               |                          |       | at polar position                   |       | at equatorial position |       |
|               | min - max                | mean  | min - max                           | mean  | min - max              | mean  |
| 1997          | 92 - 96                  | 94.0  | 22.5 - 27.0                         | 24.75 | 28.5 - 33.0            | 30.24 |
| 1998          | 94 - 96                  | 95.0  | 22.5 - 27.0                         | 24.39 | 27.0 - 33.0            | 29.85 |
| 1999          | 63 - 83                  | 74.8  | 21.0 - 30.0                         | 24.39 | 27.0 - 33.0            | 30.60 |
| 2000          | 95 - 97                  | 96.3  | 24.0 - 27.0                         | 24.99 | 28.5 - 33.0            | 30.99 |
| Average       | 86 - 93                  | 90.06 | 22.5 - 27.8                         | 24.63 | 2.8 - 33.0             | 30.42 |

of *R. multiflora* viable almost in 100% during 3 years of studies, in 1999 showed the viability only in 74.8%. The percentage of sterile grains, without protoplast was 25%. The size of well-developed, viable pollen grains did not differ in consecutive years of studies. The mean length of axis in the polar plane was  $24.63 \mu\text{m}$  ( $24.39\text{-}24.99 \mu\text{m}$ ), while in the equatorial plane it was  $30.42 \mu\text{m}$  ( $29.85\text{-}30.99 \mu\text{m}$ ), on average. These results let classify pollen grains of *R. multiflora* among medium size pollen.

#### DISCUSSION

The flowering biology, pollen production as well as the apicultural value of *Rosa multiflora* shrubs have not been investigated until now. The data presented in this paper and concerning the amount of pollen produced per 10 flowers in the year 2000 can be compared with unpublished results of studies conducted by Nadłonek in 1989 (1990). The mean values of pollen mass, produced per 10 flowers in the 1989 (17.5 mg) and in the 2000 (18.0 mg) are identical and similar to the average pollen mass for four years of studies (20.2 mg). The fluctuations of pollen mass per 10 flowers observed in consecutive vegetation seasons indicate the effect of weather conditions during microsporogenesis. A wide range between the maximum and minimum number of stamens in a single flower,



which was found every year of studies, is connected with location of a flower on an inflorescence axis. Such dependence was found earlier for cherry and apple flowers (Szkłanowska, 1984; 1987). Lipiński (1982) maintained that pollen amount produced by a single flower is a constant feature of a species. The results of this study negate his opinion. On the basis of the length of an axis measured in the polar plane (21-30  $\mu\text{m}$ ) and in the equatorial plane (27-33  $\mu\text{m}$ ), the pollen grains of *Rosa multiflora* can be ranked among medium-size grains, according to scientific literature. This size does not make formation of pollen loads difficult.

### CONCLUSIONS

In 1997-2000 *Rosa multiflora* shrubs, growing in the Lublin conditions, usually flowered from May 25<sup>th</sup> till June 15<sup>th</sup>. Every year the weather conditions influenced both the course and the character of flowering process.

A constant feature of the studied species was the opening of flower buds early in the morning, between 4:00h (5:00h) and 6:00h (7:00h) E.E.T. The number of flowers opened on shrubs on the consecutive days of blooming period depended mainly on the weather conditions in a particular year.

In consecutive years of investigations the mean number of flowers per 1 inflorescence (33), the mean number of inflorescences per 1m<sup>2</sup> of crown surface (104) as well as the average number of flowers per 1m<sup>2</sup> of crown surface (3500) fluctuated insignificantly.

The differences in the number of stamens (68-90) and the abundance of pollen production for *R. multiflora* flowers were stated between the years of studies. It was found that 100 anthers produced from 2.1 mg to 3.0 mg of pollen (2.5 mg, on average) while the mean pollen mass from 10 flowers was 20.2 mg (with a range between years from 14 mg to 29 mg).

The pollen viability reached 100%. Only, in 1999 a long-lasting drought during microsporogenesis increased the percentage of sterile grains up to 25%.

To enrich the spring pollen flow to bees, it is worth to grow *Rosa multiflora* shrubs nearby apiaries. A one hundred long, compact hedge row, planted from shrubs of this species can supply 3 to 5 kg of pollen, while a single, very decorative, free-grown bush can produced 40 to 80 g of pollen.

### REFERECES

- Basiak B., 1988. Pożytki pyłkowe z ozdobnych i dzikich gatunków f. *Rosaceae*. Praca magisterska AR Lublin.
- Bobrzyńska M., 1973. Wydajność pyłkowa gatunków z rodziny różowatych (*Rosaceae*). Praca magisterska AR Lublin.



- Bożek M., 1989. Biologia kwitnienia i pylenia róży pomarszczonej (*R. rugosa* Thunb.). PTB Katowice.
- Jabłoński B., Szklanowska K., 1997. Wpływ niektórych czynników pogody na kwitnienie, nektarowanie, pylenie i oblot przez owady zapylające entomofilnych roślin uprawnych. Biologia kwitnienia, nektarowania i zapylania roślin. Wyd. PTN, Lublin: 53-58.
- Lipiński M., 1982. Pożytki pszczele. Zapylenie i miododajność roślin. PWRiL, Warszawa.
- Nadłonek M., 1990. Biologia kwitnienia i wartość pyłku kilku dziko rosnących gatunków róży (*Rosa* L.). Praca magisterska AR Lublin.
- Szklanowska K., Pluta S., 1984. Wydajność pyłkowa sadu wiśniowego odmian Kerezer, Nefris, Łutówka. Pszczeln. Zesz. Nauk., 28,1: 63-90.
- Szklanowska K., 1987. Pszczelarska wartość jabłoni ozdobnych stosowanych jako zapylacze w sadach. Pszczeln. Zesz. Nauk., 31: 189-206.
- Szklanowska K., 1995. Pollen flows of crowfoot family (*Ranunculaceae*) from some natural plant communities. In: Changes in Fauna of Wild Bees in Europe. Pedagogical Univ., Bydgoszcz: 201-214.
- Warakomska Z., 1999. Rośliny ogrodowe i ruderalne Puław w obrazie pyłkowym obnóży pszczelich, Bibliotheca Fragmenta Agronomica 6/99: 137-144.

#### SUMMARY

Shrubs of *Rosa multiflora* Thunb. develop exceptionally small, approximately 2 cm in diameter, white and fragrant flowers. They bloom from the 3<sup>rd</sup> decade of May till the middle of June and supply bees with a large quantity of pollen. In the years 1997-2000, six free-grown shrubs of *Rosa multiflora* were studied in the Lublin area. The crown surface of each shrub was approx. 8 m<sup>2</sup>. The mean number of inflorescences per 1m<sup>2</sup> of crown surface was 104 (50-172), while the mean number of flowers on the same area was approx. 3500. The number of flowers in one inflorescence ranged from 20 to 50. In a single flower bud there were 60 to 100 stamens. The mean mass of pollen produced per 10 flowers came to 20 mg. One compound corymb supplied 31 to 164 mg of pollen, depending on inflorescence size. The pollen productivity of a single shrub ranged from 40 to 80 g, depending on the year of study. It was estimated that a 100 m long hedge row of *Rosa multiflora* can be a source of approx. 3-5 kg of pollen flow to honeybees. The viability of pollen grains, determining the pollen food value to insects, reached 95%. The size of pollen grains did not interfere in forming big pellets by insects. Those pollen loads were of characteristic gold-yellow color. During a peak of flowering between 9:00 h and 11:00 h (E.E.T), very often two honeybees foraged simultaneously on one inflorescence. Bumblebees also visited the flowers of *Rosa multiflora*, especially early in the morning. During warm and sunny days the opening of flower buds occurred only from 5:00 h till 7:00 h. All pollen was removed from anthers until 14:00 h and then the color of stamens turned from bright yellow to brownish black.

#### STRESZCZENIE

W latach 1997-2000 w Lublinie badano biologię kwitnienia i wydajność pyłkową *Rosa multiflora* Thunb. Dotychczas gatunek ten nie był opracowany pod względem wartości pszczelarskiej. Dobry oblot przez pszczołę miodną kwiatów tej róży, wyjątkowo małych i pachnących, skłonił do zajęcia się tą rośliną. Obserwacjami objęto 6 krzewów rosnących pojedynczo, w różnych odległo-



ściach od siebie, na trawnikach wśród innych roślin ozdobnych. Stwierdzono, że kwiaty *Rosa multiflora* rozkwitają tylko z rana między 5 a 7 godziną czasu wschodnio-europejskiego. Pszczoła miodna i pszczoły samotnice w celu zbioru pyłku odwiedzają kwiaty najintensywniej w godzinach między 9 a 11, natomiast trzmiele wcześniej. Pręciki rozpoczynają pylenie już w pąku. Kwiaty rozkwitłe rano wypylają wszystkie pyłek do godziny 14 a pręciki ich w tym czasie z jaskrawożółtych stają się brązowoczarne. Jeden pąk kwiatowy wytwarza od 60 do 100 pręcików. Kwiaty róży wielokwiatowej po 20 do 50 są zebrane w złożone baldachogrona. Masa pyłku dostarczana owadom pszczołowatym przez 10 kwiatów kształtowała się średnio około 20 mg, a z jednego kwiatostanu przeciętnie około 68 g. Wydajność pyłkowa z 1 m<sup>2</sup> powierzchni korony krzewu wynosiła około 7 mg (5-10), a w przeliczeniu na jeden krzew, w zależności od roku, mieściła się w granicach 40-80 g. Oszacowano, że 100 mb. wyrosniętego, nieformowanego żywopłotu z róży wielokwiatowej może dostarczać pożytku pyłkowego od 3 do 5 kg. Na ilość pyłku dostarczaną przez krzew w danym roku wpływały warunki meteorologiczne, które decydowały o obfitości kwitnienia, dorodności pręcikowia i żywotności pyłku. Ziarna pyłku tej róży są średniej wielkości i o wysokiej wartości odżywczej dla owadów pszczołowatych, gdyż ich żywotność przeważnie sięgała 95%. Do wzbogacania wiosennego pożytku pyłkowego pszczole miodnej oraz dziko żyjącym owadom zapylającym warto zalecać sadzenie krzewów *Rosa multiflora*. Kwitną one rokrocznie obficie od III dekady maja do połowy czerwca. Ten ozdobny gatunek róży wielokwiatowej dobrze rośnie i obficie kwitnie zarówno w stanie dzikim, jak i w warunkach uprawy.