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Comparison of the Single and Double Flowered Portulaca Varieties in Bee Attraction

Arunee Wongpiyasatid[1] and Praparat Hormchan[2]

ABSTRACT

New portulaca mutants of 2 single, Chompoo Praparat and Pattik, and 1 double, Som Arunee, flowered types obtained through gamma irradiation were tested for bee attraction against the original varieties of Double Pink and Double Orange. The counting of three kinds of bees, *Apis mellifera, Apis cerana indica* and *Trogina* spp, visiting each variety at a 40-minute period with 4 replicates, in the planting plot at the Department of Applied Radiation and Isotopes, Kasetsart University, were undertaken from November 2000 through February 2001. It was found that the single mutants with easy access to pollens attracted significantly greater amount of *A. cerana indica* than the double varieties which tended to hide stamens under their multi-petals. The other 2 species of bee were of too little in number to be statistically analyzed. The 5-petal mutants were also noticed to have more stamens than the multi-petal flowers did, another possibly attractive cause to bee besides the flower type.

Key words: portulaca, bee, mutants

INTRODUCTION

Portulaca grandiflora, commonly grown as a garden flower, is too little cultivated to attract the attention as a bee plant in Thailand. The annual type has a large number of single and double flowered varieties in various colours while the perennial produces only double flowers with limited colour shades. Through gamma irradiation, three mutant varieties with some characters different from the original varieties (Wongpiyasatid and Hormchan, 2000) were obtained. Chompoo Praparat and Pattik, pink and orange single form of petal respectively, and Som Arunee, deep orange double form were new mutants of pink and orange double flowered varieties.

Honeybees visit a variety of plant species to collect pollen and nectar. In the act of foraging, they incidentally perform valuable pollination services for the plants. Verma (1990) listed *P. grandiflora* as the medium honey source and major pollen source in Hindn-Kush Himalayan region. One study conducted in Egypt was cited by Page and Laidlow (1980) that portulaca eagerly sought by the bees for both honey and pollen, yielded abundantly under varied conditions and gave a sainfoin-like delicious honey.

Pellett (1978) reported that portulaca was commonly grown as garden flower but was too little cultivated to attract attention as a bee plant in USA.

There are possible reasons caused by the multi-petal type and hidden stamens of the original varieties, Double Pink and Double Orange, as well as the double flowered mutant, Som Arunee, that do not very much invite the honeybees to use them as nectar and honey sources. The new mutants

1 Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University, Bangkok 10900, Thailand.
2 Department of Entomology, Faculty of Agriculture, Kasetsart University, Bangkok 10900, Thailand.

Chompoo Praparat and Pattik, with their 5-petal flowers, new colour and easily-visualized stamens have been noticed to attract more bees. Still the study has to be conducted to confirm such observation. The results may prove to be beneficial to the beekeepers as to use the single form as the alternative honey source plant in the future. Therefore, the objective of this comparative investigation was to show that the honeybees were more attracted to single form of new mutant portulaca varieties than the original double ones.

MATERIALS AND METHODS

The mass production of *P. grandiflora* varieties including the 2 original varieties, double forms of pink and orange and the 3 new mutants, 2 single and 1 double flowered types (Figure 1), were grown in the experimental plots at the Department of Applied Radiation and Isotopes, Faculty of Science, Kasetsart University from November 2000 – February 2001.

The observation of the honeybees behaviour towards those varieties was conducted at a 40-minute period from the start of blooming in the morning. Ten flowers of each variety were randomly chosen as an observed group every day. The varieties were alternately checked first for the bees at such period, 4 replicates per variety. The number of three kinds of honeybees, *Apis mellifera, Apis cerana indica* and *Trogina* spp were recorded.

Ten flowers of the five varieties were also randomly picked to perform the counting of stamens under the microscope.

RESULTS AND DISCUSSION

General observation

Portulaca flowers of varieties tested were in bloom in accordance with temperature rather than the light. If the temperature dropped in some early mornings, even under sunny conditions, then portulaca would bloom late. It used to be as late as 10.30 am in the cold day when the first blossoms were encountered. The morning of high temperature without light, portulaca was still seen blooming.

The bees worked early in the morning and would be at planting location before the flowers were in bloom and were found to try to get in the closed flowers. Single mutants, Chompoo Praparat and Pattik, bloomed faster than the double varieties of Double Pink, Double Orange and Som Arunee resulting in bee visit in large number. Mutant Som Arunee blossoms were noticed to bloom at the latest, hence, for one possible reason, attracted the least in number of bees.

Various species of bees seemed not to mind the co-visit by the other at the same time on the same flower. Two bees were quite common spotted on the same flower, each was busy in probing for pollens and nectar without paying attention to the presence of the others (Figure 2). Until they bumped into one another, after which both of them deserted that flower to look for the new one.

The test

The results of the experiment showed the 2 mutants of single flower (Chompoo Praparat and Pattik) to have significantly higher average number of *A. cerana indica* than those of the double flowered varieties, 2 original (Double Pink and Double Orange) and 1 mutant (Som Arunee), and did not differ significantly from each other. While Double Pink and Som Arunee had statistically similar number of this honeybees, Double Orange attracted a little significant greater amount of them.

Since only small amount of *A. mellifera* were found on each variety due to its belonging to an exotic not indigenous species, statistical comparison was not undertaken and so was *Trogina* spp which was important in terms of pollination only. However, at the averages number of *A. mellifera* found, it was mostly noticeable on the single flowered mutants, except for Double Orange (Table 1). It was also revealed the average amount of *Trogina* spp to be similar in single and double

flowers of both original and mutant varieties.

Table 2 presents the average number of stamens in each portulaca variety which finds the three new mutants to have more stamens of 100.2, 98.4 and 80.2 for Chompoo Praparat, Pattik and Som Arunee respectively compared to 26.6 and 51.4 of Double Pink and Double Orange respectively. The similar results agreed with Abraham and Desai (1977) who reported the number of stamens of the 5–petal portulaca mutant obtained through gamma irradiation varying from 85 to 114.

The stamens of single mutants were found to have long-straight filament while those of double, both original and mutant varieties, had shorter and curved ones (Figure 3). It was quite apparent that such characters of a great number of easily-visualized stamens of single type would attract more bees than less amount of hidden stamens of the double.

Since sight and smell enabled bees to locate sources of pollen and nectar (Gary, 1979), the open-type of 5-petal flower should then have a chance to attract more bees than the multi-petal one as occurring in the single flowered mutants. Besides the characteristics of open-type and a great number of stamens of single mutants, Chompoo Praparat and Pattik, Wongpiyasatid and Hormchan (2000) also reported of their % pollen fertility to be higher than those of the double type. Hence, it was possible that the bees preferred the flowers with high % fertiled pollen to the low one, as seen in Som Arunee whose amount of stamens were similar to those of the single mutants but attracted less bees. While Verma (1990) reported *P. grandiflora* to be of medium honey source as well as major pollen source for the honeybees in south tropical, south temperate and temperate regions, it was possible that *A. cerana indica* preferred the easy access to pollens of the single flowered varieties to the hidden pollens of the double flowered ones. Aufsess (1960) also stated that bees were probably guided to nectaries by the differences in the odor of the nectaries and the rest of the flowers. Therefore, even with the results of the 5-petal Chompoo Praparat and Pattik having a great number of stamens with more fertiled pollen which seemed to favor the honeybees, it can not entirely be used to explain the more amount of bees on them than on the double form of Double Pink, Double Orange and Som Arunee, until the study on nectaries in all varieties have been completely conducted.

In addition, some *A. cerana indica* were still found on the double flowered varieties as well. This might be due to the observations on field bees at work suggested by Gary (1979) that a bee could not tell whether there was nectar in a given blossom without inserting her proboscis. Hence, such habit tended to make the honey bees visiting any kind of flowers in search for nectar.

As Pellett (1978) stated that the bright colored flowers were attractive to bees plus the report of Page and Laidlow (1980) on portulaca giving a sainfoin-like delicious honey, Thai beekeepers should be encouraged to look at portulaca as honey source as well as by-product of garden flowers selling. Portulaca blossoms of various bright colours are as much of pretty sight as any other blossoms in the country.

CONCLUSION

At this stage, it is possible to assume that the single flowered mutants, Chompoo Praparat and Pattik with a great number of easily-visualized stamens and high % fertiled pollens attracted more bees than the double flowered original varieties, Double Pink and Double Orange, and the mutant Som Arunee, with less amount of hidden stamens and more steriled pollens. However, the study on various effects such as stigma and nectaries of each portulaca variety should be furtherly conducted since not only petal type and stamen but also other factors can insert influence on bee visit.

Figure 1 Two original (a & b) and three mutant (c, d & e) flowers grown in the experiment.
a) Double Orange b) Double Pink
c) Pattik d) Chompoo Praparat
e) Som Arunee

Figure 2 Co-visit of 2-3 bees on double (a & b) and single (c & d) flowers for pollens and nectar.
a) Double Orange b) Double Pink
c) Pattik d) Chompoo Praparat

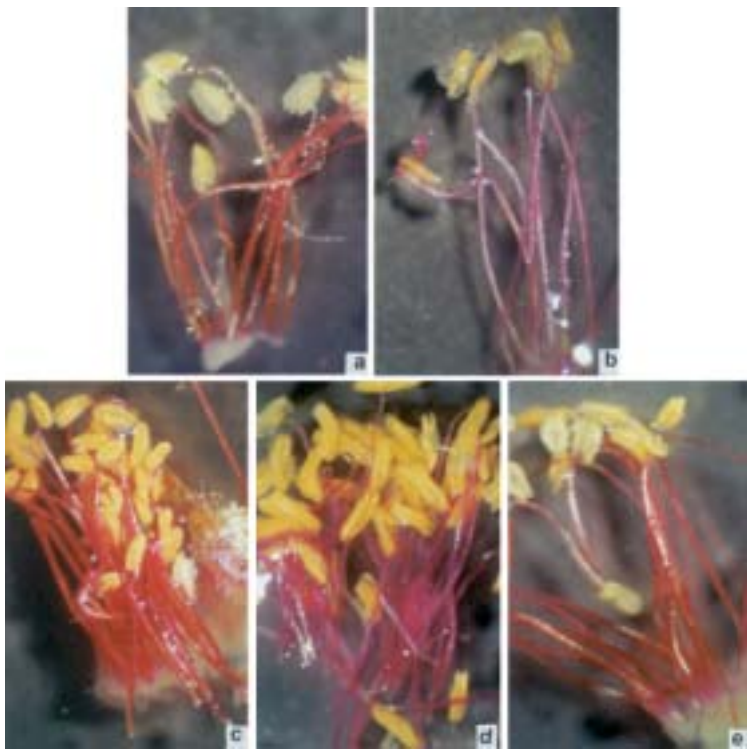

Figure 3 Characteristic of stamens of original (a & b) and mutant (c, d & e) flowers.
a) Double Orange b) Double Pink
c) Pattik d) Chompoo Praparat
e) Som Arunee

Table 1 Average numbers of different bee species found on flowers of each portulaca variety at 40–minute period between 9.30-10.10 from November 2000 through February 2001.

Variety	Ave. no. of bees		
	A. mellifera	*A. cerana indica*	*Trogina* spp.
Original			
Double Pink	0	19 a 1/	4
Double Orange	1	24 b	4
Mutant			
Chompoo Praparat	4	41 c	2
Pattik	3	45 c	4
Som Arunee	0	16 a	2

1/ Means followed by the same letter in the column were not statistically different by New Duncan multiple range test at p = 0.05

Table 2 Average number of stamens in 10 flowers of each variety.

Variety	Range	Mean ± S.E.
Original		
Double Pink	15-53	26.6 ± 3.7
Double Orange	24-82	51.4 ± 6.0
Mutant		
Chompoo Praparat	66-141	100.2 ± 7.8
Pattik	70-135	98.4 ± 5.1
Som Arunee	34-140	80.2 ± 12.2

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