

Pollination in *Pelargonium longifolium*

Dark blotches entice small fly pollinators

by Michael Struck

Different flowers attract different flower visitors – by chance or by design? Pelargonium longifolium and its tiny putative insect pollinator show, how subtle characteristics of floral design and insect behaviour render possible a steady plant-pollinator relationship.

Pelargonium longifolium (Burm. f.) Jacq. is a member of the well-known geranium family or Geraniaceae. Like most of its relatives the species is native to the southern tip of the African continent which receives rainfall during the winter months. It survives the dry summer season by means of a turnip-shaped tuber and sprouts in the beginning of spring. Flowering time is from October to December when the leaves are still present.

P. longifolium belongs to section* *Hoarea*. It is most readily distinguished from its nearest relatives by its conspicuous wine-red blotches which are presented on the upper, sharply reflexed parts of the upper petals. The lower petals are tongue-shaped and more or less straight or gradually expanded. The colour of these zygomorphic (bilaterally or left/right symmetrical) flowers varies from white to cream, yellow or pink. A considerable variation in floral colours and also size is a common feature in the genus *Pelargonium*.

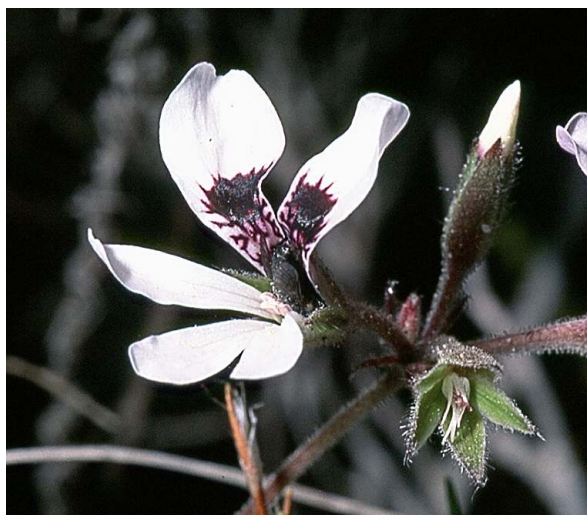
Five short stamens are enclosed in a floral sheath which is formed by the straight, claw-shaped basal parts of the petals. The anthers are arranged in a staggered fashion to form a boat-like structure loaded with pollen. The pollen is shed before the stigmas become receptive (protandry). The style is slightly longer than the stamens and the stigmas unfold just in front of the original position of the outermost anthers. A single nectar tube opens between the points of attachment of the upper petals. As is typical for the genus, the nectar tube is formed by passive excavation through the conspicuous elongation of the receptacle thus forming a unique kind of an "hypanthium". In *P. longifolium* the length of the hypanthium varies from 8 to 22 mm.

The distribution area of *P. longifolium* is confined to the south-western parts of the Western Cape Province (Marais 1994). The species has been



A Megapalpus fly alighted on a flower of *P. longifolium*.

recorded from Citrusdal in the north to the Cape Peninsula in the south and Bredasdorp in the east. The plants occur in sandy places in fynbos vegetation where they are found in usually strong but localized populations.



The fly dives into the floral sheath upside down.

In November 1994 I came across a small white-flowered population of *P. longifolium* in the Silvermine Nature Reserve which is situated on the Cape Peninsula. The stand consisted of about 10 plants scattered over a sparsely

*For explanations of scientific terms see Glossary below

covered, sandy area of roughly 25 m². The flowers were comparatively small and inconspicuous. The widest diameter (across the longitudinal axis) of the corolla was between 16.0 and 23.3 mm. The dark blotches of the upper petals exhibited a more or less rectangular shape of 3.0 to 3.2 mm in length. Nectar tube measurements varied between 10.0 and 12.5 mm. The floral sheath attained about 5 mm in length. Individual plants produced two or three pseudo-umbels with three to five flowers each presented in a circular fashion.

From the size, colour and arrangement of the flowers I expected bees as pollinators. But despite repeated observations under fairly favourable weather conditions I did not encounter any flower visitors at all. Then one morning I caught a glimpse of a small black fly perching on a flower of *P. longifolium*. The same flies were subsequently encountered throughout the population. On closer examination the flies were identified as *Megapalpus capensis* of the bee fly family (Bombyliidae). Bee flies are common flower visitors, most prominently in the arid karroid region, which are exclusively pollen and/or nectar feeders as adults. Although *Megapalpus* consists of two nominal species, entomologists agree that the genus is in fact monospecific. The flies which are about 4-6 mm long exhibit a proboscis which attains about half their body size. Unlike most of their conspicuously hairy relatives *Megapalpus capensis* shows a short and indistinct pilosity, except for a narrow but dense, whitish strip of hairs above the insertion of the wings.

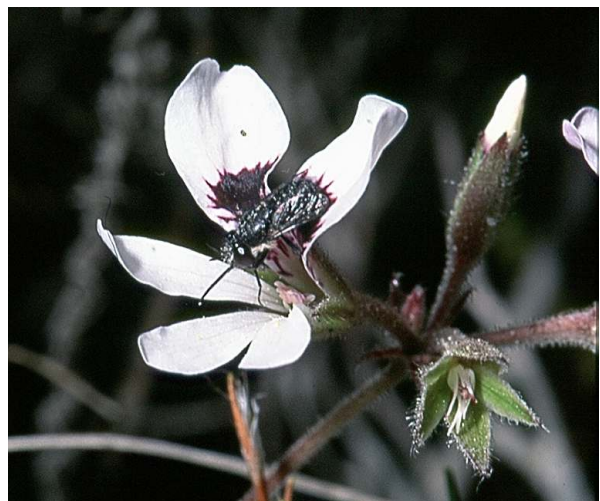
Although foraging activities were greatly impaired by moderate to strong winds which prevailed most of the time during the flowering season, *Megapalpus capensis* were consistently observed on calm, warm to hot, sunny days. The flies usually alighted on the dark spots of the upper petals. They would then dive into the floral sheath upside down, obviously to forage for nectar. As they fit snugly into the floral sheath, the anthers would touch the backside of their thorax which in turn would become dusted with pollen grains. Although it has not been proven experimentally, the observed foraging behaviour and visiting frequencies of the *Megapalpus* flies suggest that they actually acted as efficient pollinators of *P. longifolium*.

Despite the fact that *Megapalpus capensis* was the only flower visitor to *P. longifolium* recorded so far, these flies are by no means specialized on this species or even this genus. The range of other known host plants include some pelargoniums of sections *Campylia*, *Hoarea* and *Jenkinsonia* (Table 1). All these species are



The fly fits snugly into the floral sheath. Its back is touched by the anthers and dusted with pollen.

characterized by two dark, sometimes shiny or even embossed blotches on the upper (posterior) petals. The flowers are either semi-regular to hooded or funnel-shaped with the stamens borne in an almost circular fashion (sect. *Campylia* and *Jenkinsonia*) or zygomorphic and more closely funnel-shaped with the anthers borne unilaterally and enclosed in the floral sheath of the petal claws (sect. *Hoarea*). Nectar quantities appeared to be small. In all species observed so far, the dark spots are clearly significant for the orientation of the flies.



The fly emerged from the flower again. Pollen grains are clearly visible on its back.

As to the insect visitor: The *Megapalpus* flies are not flower constant nor associated to a particular floral morph or colour nor to a particular taxonomic group. However, most host plants show those markings at the base of the petals. Moreover, the known distribution area of *Megapalpus* flies stretches from as far as the Richtersveld in the north to the vicinity of Grahamstown in the east.

Table 1. Pelargonium members of the pollination guild involving *Megapalpus capensis* as their primary or exclusive pollinator.

Species	Section	Distribution
<i>P. burgerianum</i>	<i>Campylia</i>	Combined distribution covering the south-western corner of the Western Cape Province; in fynbos vegetation.
<i>P. capillare</i>	<i>Campylia</i>	
<i>P. incarnatum</i>	<i>Campylia</i>	
<i>P. ocellatum</i>	<i>Campylia</i>	
<i>P. tricolor</i>	<i>Campylia</i>	
<i>P. longifolium</i>	<i>Hoarea</i>	
<i>P. heterophyllum</i>	<i>Hoarea</i>	
<i>P. trifoliatum</i>	<i>Hoarea</i>	Richtersveld, Northern Cape Province
<i>P. tenuicaule</i>	<i>Jenkinsonia</i>	

Field experiments conducted by S. Johnson and J. Midgley involving the asteraceous *Gorteria diffusa* showed that the presence of spots drastically enhances visitation frequencies of the small flies. The same was observed for embossed versus plain spots

Acknowledgements

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Glossary

asteraceous: belonging to the plant family of Asteraceae or Compositae or daisy family.

geophytic: referring to a geophyte: A plant with an underground storage organ such as a bulb, corm or tuber.

monospecific: referring to a genus containing a single species only.

petal: usually showy leaf-like outer parts of a flower which often serve to attract insects or other animals.

pollinator: a flower visiting animal which in the process of feeding on the flower is effecting the transfer of pollen from flower to flower.

References and further reading

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pseudo-umbel: false umbel, a type of inflorescence or 'arrangement' of flowers.

receptacle: the end of the stem bearing the floral organs.

section: a category in the classification system between genus and family. Classification serves the purpose of convenience of reference and shall reflect evolutionary relationships.

stamen: the male part of the flower which produce pollen.

taxonomy: the branch of natural sciences dealing with the classification of organisms.