Most species of the family Hydrophyllaceae are found in western North America. Phacelia is probably the most familiar genus as many species are popular garden plants. Codon, with only two species, is the sole genus of the family indigenous to southern Africa, to which it is restricted. These plants are very different from the familiar garden Phacelia, being robust and protected from browsers by numerous straight white spines on the stems and leaf margins. The generic name is derived from the Greek word kodon meaning boll and refers to the shape of the flowers which are deeply cup-shaped. However, they do not hang down in the manner of a bell but are held erect. Those of Codon royenii are relatively large, approximately 4 cm in height, and white and those of C. schenckii are smaller and yellow. Both species are found in Namibia and Namaqualand, and the former occasionally in dry areas to the south.

In the course of our research on the wasps and bees of semi-arid areas, Fred Gess and I have found C. royenii most abundantly in the dry gravelly drainage channels of the northern Richtersveld of Namaqualand and across the Orange River in similar drainage channels in the southern Sperrgebiet in Namibia. The Nama people collect the flowers as a delicacy, attracted by the copious sweet nectar. It is for this nectar that they are named in Afrikaans, suikerkolk (sugar chalice). Care should be taken when picking the flowers as the spines inflict unpleasant wounds on the unwary as Thunberg noted in 1774 that 'for several days' after collecting the flowers he 'experienced great pain and inconvenience'!

When one first looks into a flower one is surprised that the nectar is not immediately visible. However, if one breaks the flower open, abundant nectar runs out from 'secret' compartments beneath the 'false' bottom of the cup. What appears at first glance to be the bottom of the flower is in fact tightly adpressed, hairy, staminal filaments curving downwards from the cup walls at 5 mm above the true bottom of the flower. Above this level the filaments separate and rise upwards and outwards to hold the anthers erect.

The insect pollinators, for whom the nectar reward is produced, require long tongues which can be inserted between the filaments to reach the nectar. To be an effective pollinator a visitor must visit a succession of flowers and, when entering a flower in the pollen presenting phase, must brush against the outwardly turned anthers and then, when later entering another flower with stigmas in the pollen receptive condition, must brush off some of the pollen onto these stigmas.

The perfect pollinator: a carpenter bee, Xylocopa lugubris, drinking nectar from a flower of Codon royenii. In so doing it brushes against the anthers, when in the pollen presenting phase, and with the stigmas when they are receptive.

We have observed C. royenii flowers in the Richtersveld in three successive springs and found that although they received occasional visits from some other bees and wasps, they were most often visited by a black carpenter bee with rufous legs - Xylocopa lugubris (Apidae: Anthophorinae) - and two species of pollen wasps (Vespidae: Masarinae). The larger pollen wasp is a black and white species of jugurtia, recently named by Fred Gess J. codoni. The smaller, which is more colourful being predominantly reddish brown and yellow, is an undescribed and unnamed species of Quartinioidea.

The robust carpenter bee flies straight into the flowers with its underside towards the centre of the flower. In so doing it makes contact with the anthers, when in the pollen presenting phase, and with the stigmas when in the receptive phase - the perfect pollinator for these flowers. Xylocopa lugubris, which nests in dry pithy stems, usually of Abie inflorescences, is widespread in Africa and is therefore available throughout the range of Codon royenii. Indeed we have watched these bees similarly engaged further.
south in a drainage channel just north of Springbok. It is likely, however, that, although it is the only Xylocopa we have found visiting the flowers, other carpenter bees also suited to pollinating them will be found visiting them.

We have not yet established the distribution of the pollen wasps but to date we have found Jaguria codoni only in the Richtersveld south of the Orange River, and the Quurtinioides species only in the northern Richtersveld and southern Sperrgebiet. Both these wasps, when visiting the flowers to collect nectar, alight on the outwardly curved lip of the flower, walk down the side of the flower and insert their tongue between the filaments without coming into contact with the anthers or stigmas. When collecting pollen such a wasp grasps a filament below the anther and ingests pollen directly. In September 1997, the Quurtinioides were particularly numerous but the weather was inclined to be cool and breezy. The white flowers which caught the sun and offered shelter from the wind were crowded with these little wasps, not only drinking nectar and collecting pollen but also sunning themselves, courting and mating.

However, although the wasps are more restricted in flower choice than the carpenter bees and are therefore more dependant on Codon than are these bees, their size and behaviour in the flower preclude them from being pollinators. In this they differ from most of the pollen wasps in southern Africa, which fit the flowers with which they are associated and are therefore reliable pollinators.

POLLEN WASPS

Wasps of the subfamily Masarinae are sometimes called pollen wasps because they are the only wasps that - like bees - provision their nest cells with pollen and nectar. Numbering a little over 300 known species, they favour regions of the world with hot, dry summers and scrubby vegetation, and are especially plentiful and diverse in southern Africa, where Sarah Gess has made the study of aculeate Hymenoptera, including those fascinating insects, her life's work.

The Pollen Wasps by Sarah Gess, was published by Harvard University Press in 1996, the product of more than twenty years of study and field experience. It is the first new work on masarinae wasps since 1962 and includes data on all that is known about the masarines: their biogeography, life history, nest-building behavior, myriad flower associations, and the associated insects such as parasites, scavengers, nest 'cuckoos', and predators.