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## Review of *Andrena rosae*: ISO, ELSE & EDWARDS: 2018 in Cornwall

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*Andrena rosae* was designated as Vulnerable RDB2 in Shirt (1987) and Falk (1991) but the status is currently under review. This solitary bee has a very limited distribution in the UK. The BWARS current records indicate a retreat to Exmoor, South Wales and Cornwall (Else & Edwards 2018). The bee may be extinct in Ireland and is threatened or Red Data Book listed in five other EU Countries (Fitzpatrick et al., 2006). *A. rosae* has strong populations in the Land's End or West Penwith area in Cornwall and West Penwith Moors may support the strongest population of this bee in the UK. Spooner (1984) in his Cornish aculeate register notes that this bee "has become scarcer in recent years".

The species occurs in two broods. Some authors, notably Westrich (2014; 2018), have considered the two broods are from separate species, *Andrena stragulata* (spring) and *A. rosae* (summer). Genetic studies (Reemer et al., 2008) and other authors (Van der Meer et al., 2006; Falk, 2015; Else & Edwards, 2018) argue that there is just one species, *A. rosae*.



Fig. 5: Spring brood female *Andrena rosae* on *Salix* © Patrick Saunders

### Foraging Ecology on West Penwith Moors

In 2014 and 2015 Natural England commissioned surveys for this species in West Cornwall (Saunders, 2015). This article reviews both this publication and subsequent recording centred in the West Penwith area.

Individuals of the summer brood have been recorded in much greater abundance than those of the spring brood. On one summer brood site 20 females were recorded whereas the spring

brood were usually found as single individuals or occasionally a few. This probably suggests that the spring brood is more dispersed in the landscape.

The spring brood bee has been recorded foraging on various Willows *Salix* sp., Blackthorn *Prunus spinosa*, Hawthorn *Crataegus monogyna* and Sycamore *Acer pseudoplatanus*. The highest spring counts were on the less common Eared Willow *Salix aurita*. The Eared Willow flowers later than the commoner Grey Willow *Salix cinerea*. Westrich suggests the spring brood (as *stragulata*) is polylectic, using Asteraceae, Rosaceae and Salicaceae (Westrich 2014). Judy Webb has confirmed pollen from Rosaceae and *Acer* in Cornish spring brood samples (Webb 2016) whereas in Holland pollen analysis of the species indicated that pollen had been collected only on *Salix* (Van der Meer et al., 2006). It seems most likely that the species needs a mixed range of pollen sources throughout the spring season but particularly Eared Willow and Blackthorn. Figure 6 shows an ideal site at Rosemorran Valley (SW462377) consisting of ungrazed wet grassland with both plants. The bee needs scrub edge habitats with low grazing pressure but some management to maintain open grassland.



Fig. 6: Spring forage site, Rosemorran Valley  
© Patrick Saunders

Rosemorran is also perfect for the summer brood since it has an abundance of Wild Angelica *Angelica sylvestris*, with which that brood has a strong association in Cornwall, with the highest counts and greatest number of records. Spooner (1984) recorded summer brood *Andrena rosae* only on *Angelica*. Westrich (2018) considered the summer brood to be oligolectic on Apiaceae (as *A. rosae*) and other studies have confirmed a strong link to Apiaceae (Van der Meer et al., 2006). Pollen analysis of six summer brood bees by Judy Webb showed all to be collecting Apiaceae (umbellifer) pollen. The bee has been observed twice collecting pollen on Hogweed *Hieracium sphondylium*, which is probably a forage of secondary importance, as it tends to flower before the peak flight period. *Angelica* is perhaps more suitable as it flowers slightly later. Figure 7 shows Woon Gumpus Common (SW394334), dry heathland edge with abundant *Angelica* and other ruderal plants.



Fig. 7: Summer forage site, Woon Gumpus Common  
© Patrick Saunders

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Fig. 8: Summer brood female *Andrena rosae* on *Angelica* © Patrick Saunders

Outside the West Penwith Moors area on the smaller number of Cornish coastal sites the summer brood is almost always recorded on Bramble *Rubus fruticosus* agg. Porthcurno and Boscastle have almost no *Angelica* and relatively small amounts of Hogweed. On these sites the numbers recorded are poorer than on the *Angelica*-rich inland sites. Two samples were taken from these sites and collection from Rosaceae was confirmed from both with one sample containing all Rosaceae (Webb, 2016). Else & Edwards (2018) cite additional summer pollen sources: Asteraceae, Field Eryngo *Eryngium campestre* and Meadowsweet *Filipendula ulmaria*.

The spring foraging requirements are all abundant in Cornwall and are probably not limiting but the summer brood's requirements are more likely to be. *Angelica* may be reduced by preferential grazing, it is liked by cattle, although probably not by rabbits which were providing very good conditions for this bee at one site.

### **Nest ecology and climatic niche**

Nest sites are an additional requirement. Van der Meer et al. (2006) found solitary females nesting on clay dyke banks, facing south, west or south east and with short, grassy vegetation. Else & Edwards (2018) cite observations of the bee nesting in bare ground and compacted paths either solitarily or in small aggregations.

The best sites in Cornwall for *Andrena rosae* are coastal sites and western moorlands with a cooler Atlantic climatic. The modern distribution of West Penwith Moors, The Lizard, North Cornwall, Bodmin Moor, Exmoor and historical Dartmoor matches very well areas with a maximum summer average temperature of below 17.5°C (metoffice.gov.uk, 2020). It seems likely a suitable thermal niche is important for nesting and/or for *Angelica*-rich habitats.

Spooner (1984) did not comment on the status of the similar *Andrena trimmerana*: ISO. ELSE & EDWARDS: 2018 but there were hardly any records for this species in his review, whereas now it is widely recorded in Cornwall and frequent on coastal sites. The bee is probably expanding in the Midlands (Falk, 2015). I suspect that *A. trimmerana* has an advantage on warmer sites and with climate change is expanding and possibly outcompeting *Andrena rosae* on some former sites. Two sites with recent records on the South Cornish Coast, Rose-land and Rosemullion, may be on the edge of the climatic niche and may either prove or disprove this hypothesis over time.

### Spatial relationship between spring and summer broods

It is difficult to find studies of the relationship between different generations of bivoltine (double-brooded) bees. I have done a brief analysis of the spatial relationship between spring brood and summer brood sites. This included sites with six- or eight-figure grid references and reasonable survey effort (visited at least once both in spring and summer), mostly in the West Penwith Moors area. Some duplicates and other sites with limited survey effort where excluded.

The mean distance between a spring-brood record (N=19) and the nearest two summer-brood records (N=57) was 687m with an error of 100m either side as some records are six-figure grid references.

Both broods were recorded only once within the same six-figure grid reference in this study, although the mean distance is well within the 900m maximum foraging distance of *Andrena hattorfiana*: ISO. PERKINS: 1919 (Franzen et al., 2009), which is of a similar size.

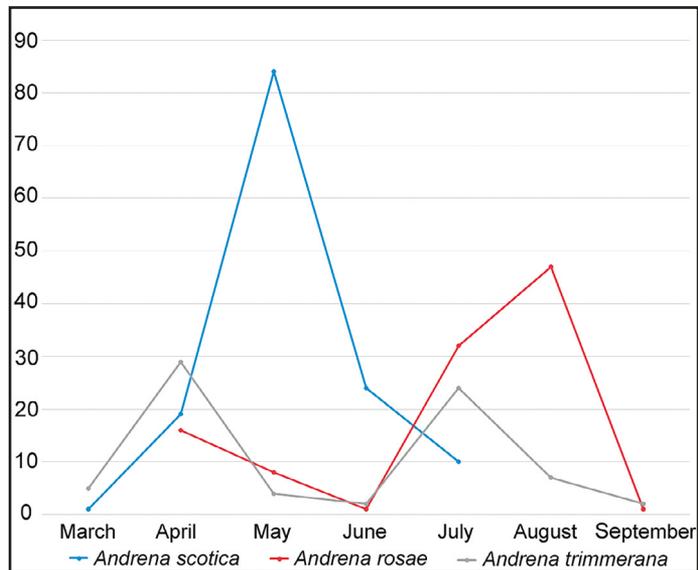


Fig. 9: Flight periods of *Andrena* species in Cornwall  
© Patrick Saunders

### Discussion

Genetic studies (Reemer et al., 2008) and the British bee handbooks (Falk, 2015; Else & Edwards, 2018) have considered *Andrena rosae* a single species. Westrich (2014; 2018) posited the spring brood and summer brood as two different species based on the hypothesis that a polylectic spring generation cannot produce an oligolectic summer generation.

The Cornish review is consistent with Westrich’s findings on foraging preferences, although it does suggest that the summer brood may not be completely oligolectic. Inconsistencies

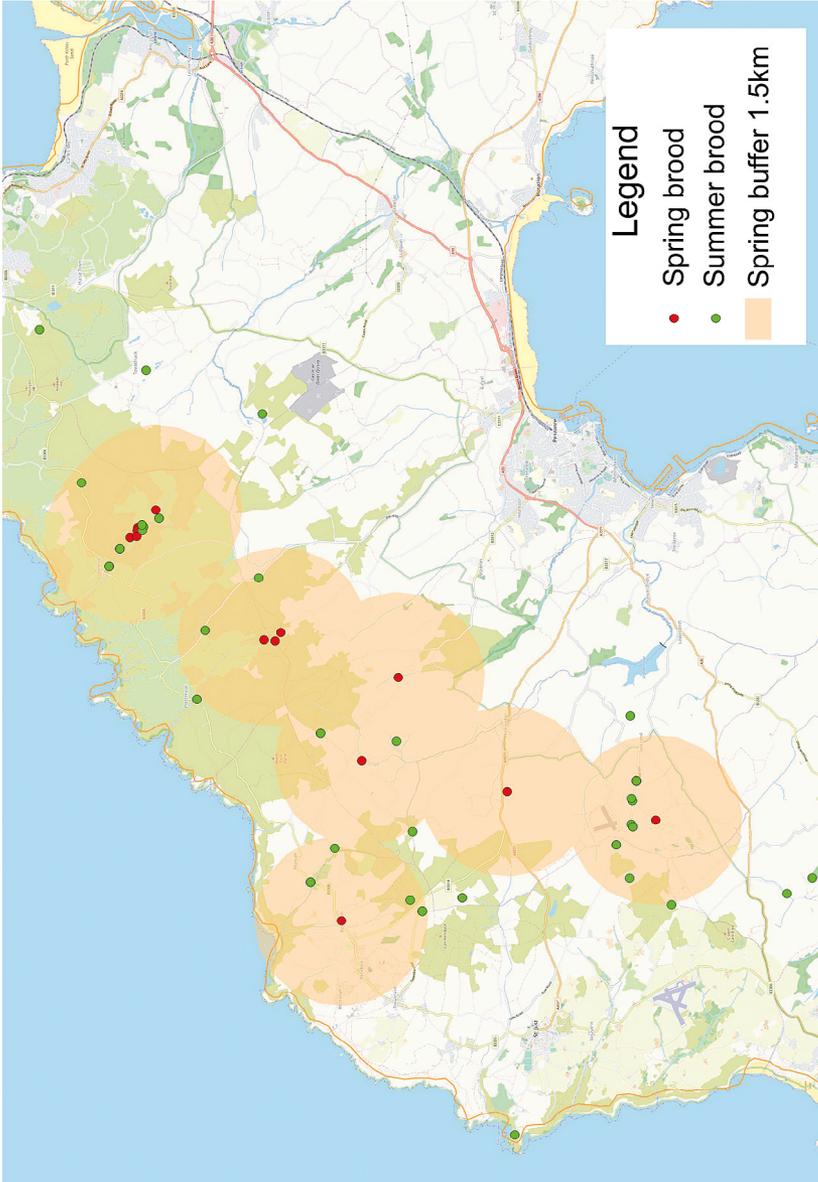


Fig. 10: Distribution of spring and summer broods of *Andrena rosae* in West Penwith, Cornwall.  
Map produced by Patrick Saunders using QGIS 2.18, base map from OpenStreetMap

in foraging preferences between broods are not unknown, Thomas Wood (pers. comm.) observes that the non-British species *Andrena mucida* Kriechbaumer shows strong preferences for different botanical families in each generation and *Andrena nana*: ISO. AMIET ET AL.: 2010 and *Andrena minutuloides*: ISO. AMIET ET AL.: 2010 show strong preferences for umbellifers (Apiaceae) only in the second generation.

The spatial analysis (Figure 10) does support the single species theory. Isolated sites such as the only modern site on Bodmin Moor and the only site in North Cornwall have both broods present and strongly suggest one species. In West Cornwall the summer brood was found in much larger numbers than the spring brood, this could support the idea of there being two species but is likelier to be explained by the fact that bees are more difficult to find in trees and high scrub than on *Angelica*.

Over the survey period I spent some time looking for nests unsuccessfully. Van der Meer et al. (2006) were unable to find summer individuals at the nest sites he found in spring. The data and lack of nest observations could suggest the bee nests singly. Habitats with abundant *Angelica* are more restricted than spring flowering scrub habitats in West Cornwall, and given the assumption that the mother cannot predict how many flowers will be there for the daughters this could promote movement from natal nests and dispersed nesting.

More research is needed to establish the relationship between spring and summer broods and how this is linked with foraging and nesting behaviour. There are many questions, such as could foraging preference traits exist in both broods and be unexpressed or unused in one generation through lack of feasibility? I would suggest that this bee is more mobile, more dispersed in the landscape and less faithful to nest aggregations than single-brooded summer meadow specialists. There are still many questions left to answer.

Conservation effort for this bee are best directed to conserving stands of *Angelica*, which can be rich in invertebrates including aculeates and diptera. *Angelica* occurs in West Cornwall often in ruderal and scrub edge habitats, frequently in marginal areas which are difficult or uneconomic to farm conventionally. These sites can be threatened both by neglect and intensive farming. A likely future threat is new woodland creation targets.

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