# 9. ARACHNIDS

by PAUL A. SELDEN

Chelicerates can be conveniently divided into mainly aquatic animals (horse-shoe crabs, eurypterids and other Palaeozoic forms) and the primarily terrestrial Arachnida. Being an essentially non-marine succession, the Wealden has so far yielded only arachnid chelicerates, though horseshoe crabs have been reported from Cretaceous freshwater systems (Riek and Gill 1971) and so could occur in Wealden beds. Twenty years ago it was a red-letter day when an arachnid was discovered in Cretaceous strata (e.g. Selden 1989), but they are now well known from lacustrine deposits such as the Crato Lagerstätte in Brazil, the Yixian Formation in China, and the Zazinskaya Formation in Russia, as well as from many Cretaceous ambers (see Selden and Penney 2010 for a review). Cretaceous arachnids include spiders (Araneae), harvestmen (Opiliones), mites and ticks (Acari), scorpions (Scorpiones), pseudoscorpions (Pseudoscorpiones), camel-spiders (Solifugae), whip-spiders (Amblypygi) and whip-scorpions (Uropygi), but of these, only spiders occur with any regularity. Almost always, fossil arachnids co-occur with their insect prey, and the insect fossils are discovered first, sometimes decades before any arachnid turns up, if at all. Many insect fossils have now been described from the Weald Clay Group of south-east England (Batten 1998; Chapters 13–14), so it should only be a matter of time before arachnids are discovered in these beds. The arachnid fossils described here are from Wealden ambers.

Arachnids are readily identified by counting the number of legs (eight walking legs, only six in insects). Should not all walking legs be preserved then an arach-nid leg is distinguishable from that of an insect by the presence of a distinct knee segment, the patella, between femur and tibia, whereas in insects there is no such segment. Moreover, arachnids lack wings and have only one or two readily visible body parts (tagmata: prosoma and opisthosoma), which may be clearly separated, as in spiders, or broadly joined, as in Opiliones (whose bodies have the appearance of consisting of a single tagma), whereas insects have three easily distinguished body parts: head, thorax and abdomen.

Evidence of fossil arachnids in the Wealden succession of south-east England comes from both the Wessex Sub-basin, in the form of a spider (Selden 2002; Text-figs 9.1A, 9.2A) and undescribed web fragments (Jarzembowski et al. 2008) in amber from the Isle of Wight; and the Weald Sub-basin, where spider silk has been reported from amber near Hastings (Brasier et al. 2009; Text-fig. 9.1B–C). Fossil arachnids are relatively rare, even in amber, which is also uncommon in Mesozoic strata. The Wealden amber is among the oldest known with arthropod inclusions, so these finds are quite important contributions to the arachnid geological record.
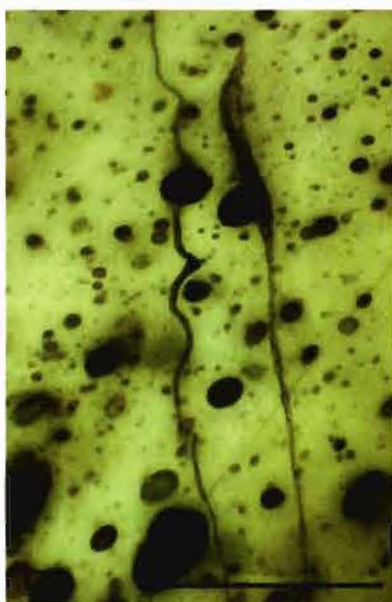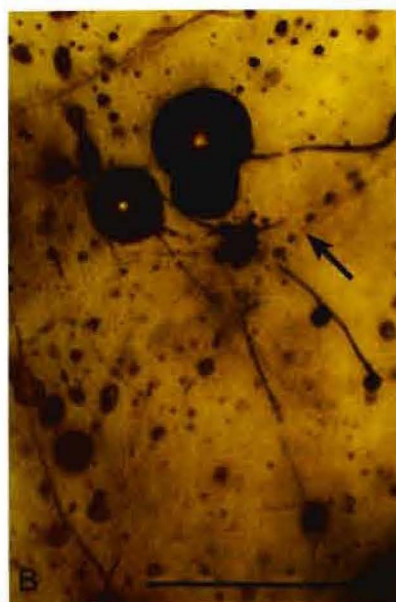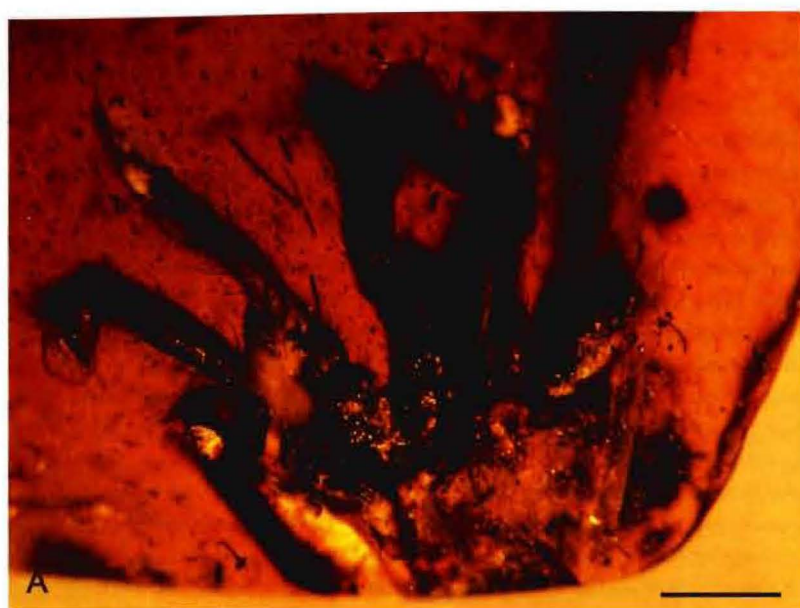
The Isle of Wight spider specimen comes from amber found in plant-debris bed L6 (see Text-figs 4.4, 4.11) exposed at beach level about 250 m south-east of the mouth of Chilton Chine (Nicholas *et al.* 1993; Text-figs 4.2, 4.17A). Amber occurs in two horizons rich in comminuted plant debris separated by about 10 cm of blue-grey clay and silt with large, lignitic logs. These horizons form part of a typical fining-upward plant-debris bed sequence of Barremian age, *c.* 128 Ma (Sweetman and Insole 2010).

The spider is preserved in clear, medium-coloured amber with a large number of tiny air bubbles and carbonized plant fragments. Adpressed against the spider, obscuring the anterior part of the sternum, is a piece of indeterminate arthropod cuticle. About half of the spider occurs in the amber; the remainder is missing owing to erosion or preparation of the amber piece, or because the spider was not entirely engulfed in amber and the missing parts decayed away. The abdomen and longer podomeres of the spider are deflated, as occurs rapidly in spiders after death because of dehydration. Since the spider is complete apart from the missing parts beyond the edge of the amber piece, and the carapace is in place, it is presumably a dead spider rather than a moult. Much of the specimen is covered, both internally and externally, with white or brown fuzz. Such fuzz is very common in Baltic amber, and is a result of reaction of the amber-producing resin with moisture during early fossilization. Unfortunately, it obscures some important details.

The Hastings amber was recovered from an exposure of Fairlight Clays facies on the Sussex coast between St Leonards and Bexhill-on-Sea, east of the Old Town Fault (Chapter 3). At this locality the mudstones are thought to be high in the Ashdown Formation and, therefore, of Berriasian–Valanginian in age (*c.* 140 Ma; Brasier *et al.* 2009). The pieces of amber occur in floodplain deposits associated with coniferous (probably cheirolepidiacean) twigs and logs of wood. It was studied in various ways, including slicing off small flakes that could be studied under the microscope. Within some flakes, abundant thread-like structures occur, which vary from <1 to 10 μm in diameter and up to *c.* 1 mm in length. The threads can be distinguished from associated fungal and prokaryotic filaments because they often show variations in thickness along their length; threads commonly occur in twisted pairs; many threads are coated by fluid droplets; and the threads invariably lack any evidence for cellular organization such as regular cell-wall divisions or reproductive bodies.

TEXT-FIG. 9.1. A, *Cretamygale chasei* Selden, Barremian, Wessex Formation, Isle of Wight. Lateral view of complete specimen in amber. See Text-figure 9.2 for explanation. B, possible spider silk, Berriasian–Valanginian, Ashdown Formation, near Hastings, Sussex (from Brasier *et al.* 2009). Arrow points to strand with regularly spaced glue droplets indicative of an araneoid spider. C, possible spider silk, Berriasian–Valanginian, Ashdown Formation, coast between St Leonards and Bexhill-on-Sea, Sussex (from Brasier *et al.* 2009). Distinctive coiling in strand which compares to that observed in modern araneoid silk in viscous fluids. Scale bars represent 1 mm in A, 100 μm in B–C.

English Wealden Fossils

Glue droplets are characteristic of spiders' webs woven by araneoids, and twisting and pairing was observed by Brasier *et al.* (2009) in taphonomic studies of modern araneoid spider silk in canola oil. These authors concluded that an araneoid spider was most likely to have been responsible for the Hastings webs. Such glue droplets on fossil spider silk have been described from numerous ambers (Zschokke 2004).

SYSTEMATIC PALAEONTOLOGY

Phylum ARTHROPODA
Subphylum CHELICERATA
Class ARACHNIDA
Order ARANEAE Clerck
Suborder OPISTHOTHELAE Pocock
Infraorder MYGALOMORPHAE Pocock

Remarks. Mygalomorphs are the bird-eating, funnel-web and tarantula spiders. They are commonly larger than the araneomorphs, or 'true' spiders, and generally rather hairy. They are usually sedentary, living in burrows, and are long-lived. Only adult males and spiderlings dispersing from the mother's burrow are commonly found wandering and, therefore, likely to be entrapped in amber.

BIPECTINA Goloboff, 1993
Family NEMESIIDAE Simon
Genus CRETAMYGALE Selden, 2002

Remarks. There is a single species described from a single specimen in this genus, so the species description below applies equally to the genus. *Cretamygale* was assigned tentatively to Nemesiidae on the basis that nemesiids generally show a more raised, and less hirsute, cephalic region of the carapace than diplurines, in which the thoracic region is commonly higher than the caput (Raven 1985; see Text-fig. 9.2B).

Cretamygale chasei Selden, 2002
Text-figures 9.1A, 9.2

Description. Bipectinate (nemesiid?) mygalomorph with ocular tubercle, caput not strongly raised, sloping thoracic region, pair of erect setae on anterior wall of fovea; symmetrically arranged scopulae on tarsus and metatarsus of at least leg 1, tarsus cracked ventrally, no claw tufts.

TEXT-FIG. 9.2. *Cretamygale chasei* Selden. A, explanatory drawing to accompany Text-figure 9.1A. 1–4, walking legs 1–4; ch, chelicera; cx, coxa; fe, femur; mt, metatarsus; op, opisthosoma; pa, patella; pd, pedipalp; st, sternum; ta, tarsus; ti, tibia. B, drawing of specimen from left lateral aspect, anterior to left. 1–4, walking legs 1–4; car, carapace; ch, chelicera; cx, coxa; fe, femur; op, opisthosoma; pa, patella; pd, pedipalp; ti, tibia. Scale bars represent 1 mm.

A

B

English Wealden Fossils
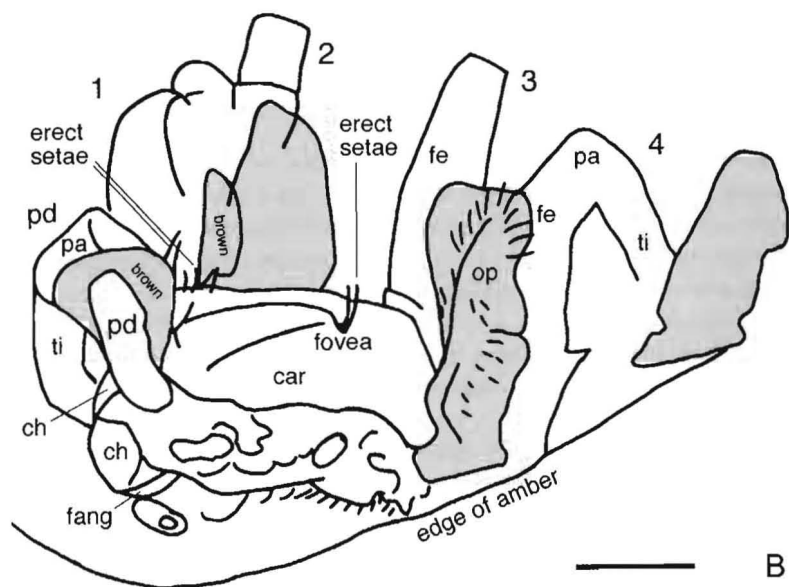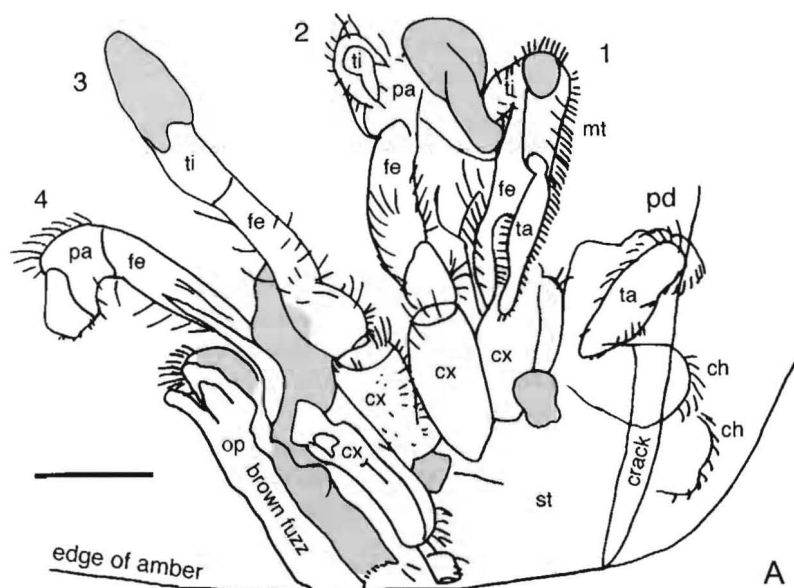
Occurrence. Barremian: Chilton Chine amber, south-west coast of the Isle of Wight at about SZ 411821.

Spider silk

Text-figure 9.1B–C

Remarks. Spiders' webs and silk have been known as inclusions in Cenozoic ambers for many years (e.g. Bachofen-Echt 1934), but distinguishing spider silk from other organic strands can be challenging. If the silk originates from members of the common spider superfamily Araneoidea, then the regularly spaced glue droplets (Text-fig. 9.1B) are a good clue to its origin. Additionally, the Hastings amber strands show a type of coiling (Text-fig. 9.1C) that Brasier *et al.* (2009) found to be similar to that which they observed in taphonomic experiments with modern araneoid silk. **Occurrence.** Berriasian–Valanginian: Ashdown Formation, coast between St Leonards and Bexhill-on-Sea, Sussex.