generations in the year and form reelable cocoons. Besides these there are many other mulberry-feeding *Bombycidae* in the East, principally belonging to the genera *Theophile* and *Ocinara,* the cocoons of which have not attracted cul­tivators. The moths yielding wild silks which have obtained most attention belong to the extensive and handsome family *Saturnidae.* The most important of the species at the present time is the Chinese tussur or tasar worm, *Antheraea pernyi* (figs. 7,8), an oak­feeding species, native of Mongolia, from which is derived the greater part of the so-called tussur silk now imported into Europe. Closely allied to this is the Indian tussur moth (fig. 9) *Antheraea mylitta,* found throughout the whole of India feeding on the bher tree, *Zizyphus jujuba,* and on many other plants. It yields a large compact cocoon (fig. 10) of a silvery grey colour, which Sir Thomas Wardle of Leek, who devoted a great amount of attention to the wild-silk

question, succeeded in reeling. Next in promising qualities is the muga or moonga worm of Assam, *Antheraea assama,* a species to some extent domes­ticated in its native country. The yama-mai worm of Japan, *Antheraea (Samia) yama-mai,* an oak-feeder, is a race of considerable importance in Japan, where it was said to be jealously guarded against foreigners. Its eggs were first sent to Europe by Duchêne du Bellecourt, French consul- general in Japan in 1861; but early in March following they hatched out, when no leaves on which the larvae would feed were to be found. In April a single worm got oak-buds, on which it throve, and ultimately spun a cocoon whence a female moth issued, from which Guérin Méneville named and described the species. A further supply of eggs was secretly obtained by a Dutch physician Pompe van Meedervoort in 1863, and, as it was now known that the worm was an oak-feeder, and would thrive on the leaves of European oaks, great results were anticipated from the cultiva­tion of the yama-mai. These expectations, however, for various reasons, have been disappointed. The moths hatch out at a period when oak leaves are not ready for their feeding, and the silk is by no means of a quality to compare with that of the common mulberry worm. The mezankoorie moth of the Assamese, *Antheraea mezankooria,* yields a valuable cocoon, as does also the Atlas moth, *Attacus atlas*, which has an omnivorous larva found throughout India, Ceylon, Burmah, China and Java. The Cynthia moth, *Attacus cynthia,* is domesticated as a source of silk in certain provinces of China, where it feeds on the *Ailan- thus glandulosa.* The eria or arrindi moth of Bengal and Assam, *Attacus ricini,* which feeds on the castor-oil plant, yields seven generations yearly, forming loose flossy orange-red and some­times white cocoons. The ailanthus silkworm of Europe is a hybrid between *A. cynthia* and *A. ricini,* first obtained by Guérin Méneville, and now spread through many silk-growing regions. These are only a few of the moths from which silks of various usefulness can be produced; but none of these presents qualities, saving perhaps cheapness alone, which can put them in competition with common silk.

*Physical and Chemical Relations of Silk.*

Common cocoons enclosing chrysalides weigh each from 16 to 50 grains, or say from 300 to 600 of small breeds and from 270 to 300 of large breeds to the lb. About one-sixth of this weight is pure cocoon, and of that one-half is obtainable as reeled silk, the remainder consisting of surface floss or blaze and of hard gummy husk. As the outer flossy threads and the inner vests are not reelable, it is difficult to estimate the total length of thread produced by the silkworm, but the portion reeled varies in length and thickness, according to the condition and robustness of the cocoon, in some breeds giving a result as low as 500 metres, and in others *goo* to 1200 metres. Under favourable conditions it is estimated that 11 kilo­grammes of fresh cocoons give 1 kilogramme of raw silk for commerce, and about the same quantity for waste spinning purposes. Sir Thomas Wardle of Leek, in his handbook on silk published in 1887, showed by a series of measurements that the diameter of a single cocoon thread or bave varied from 1/1600th to 1/2400th part of an inch in diameter in the various species of Bombycides, whilst those of the Saturnides or wild species varied from 1/600th to 1/1100th part of an inch. As this estimation presents some difficulties and diver­gences, the size of the thread is generally defined commercially by deniers or decigrammes, those of the Anthereas (wild silks) being said to range from 5 to 8 deniers or decigrammes, results confirmed by actual experience with the reeled thread. The silk of the various species of *Antheraea* and *Attacus* is also thicker and stronger at the centre of the reeled portion than towards its extremities; but the diameter is much greater than that of common silk, and the filaments under the microscope (fig. 11) present the appearance of flat bands, the exudation from the two spinnerets being joined at their flat edges. On this account the fibres of tussur or tussore silk tend to split up into fine fibrillae under the various preparatory processes in manufacturing, and its riband structure is the cause of the glassy lustre peculiar to the woven and finished fibres.

Silk fibre (see Fibres) consists essentially of a centre or core of fibroin, with a covering of sericin or silk albumen, and a little waxy and colouring matter. Fibroin, which is analogous to horn, hair and like dermal products, constitutes about 75 to 82 % of the entire mass, and has a composition represented by the formula C15H23N5O6. It has the characteristic appearance of pure silk—a brilliant soft white body with a pearly lustre—insoluble in water, alcohol and ether, but it dissolves freely in concentrated alkaline solutions, mineral acids, strong acetic acid and in ammoniacal solution of oxide of copper. Sericin, which constitutes the gummy covering (Fr. *grès)* of the fibre, is a gelatinous body which dissolves readily in warm soapy solutions, and in hot water, in which on cooling it forms a jelly with even as little as 1 % of the substance. It is precipitated from hot solutions by alcohol, falling as a white powder. Its formula is C15H25N5O8. According to P. Bolley, the glands of the silkworm contain semi-liquid fibroin alone, and it is on exposure to the air that