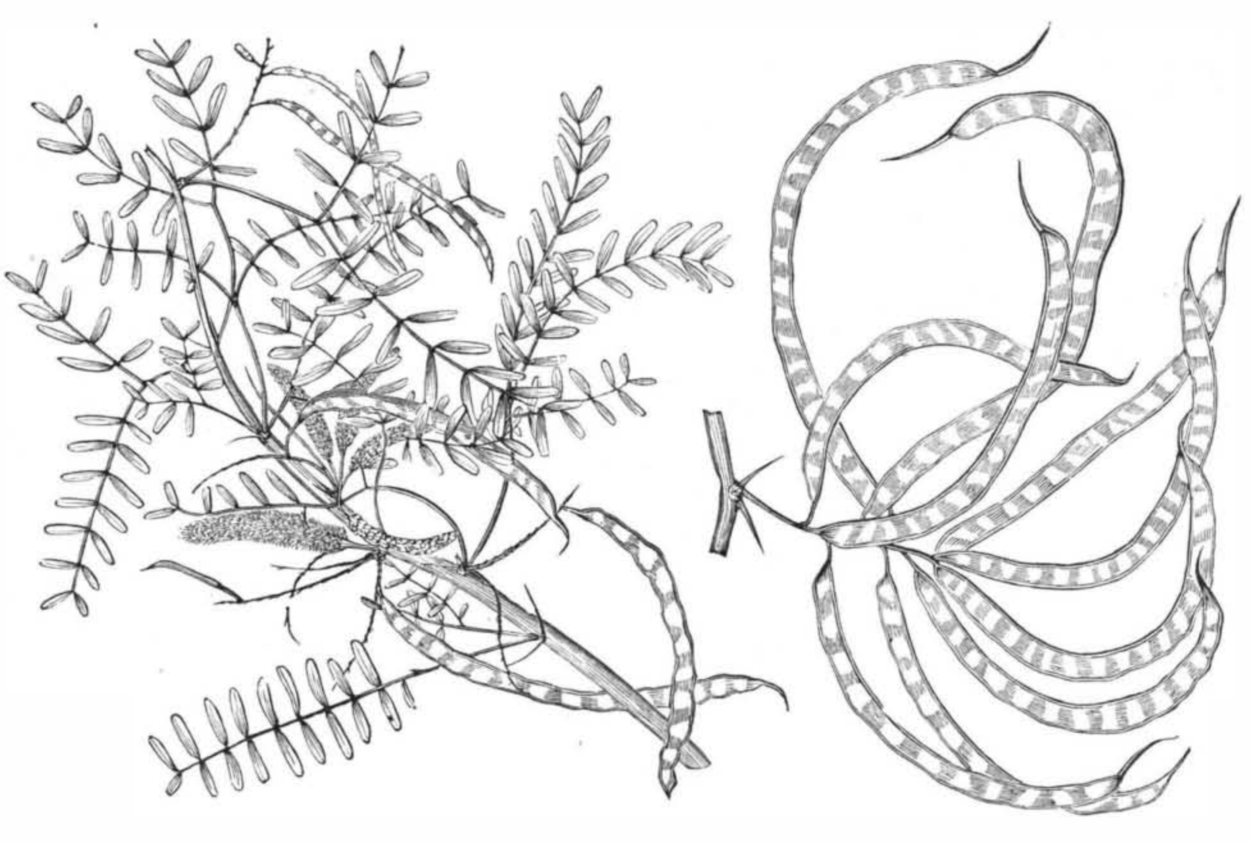
THE MESQUITE.

An industry that promises, perhaps, to be of considerable importance has recently sprung up in the West. The mesquite, a common tree of the deserts, and closely allied, botanically, to the acacia, yields, like the latter, a gum which closely resembles and in fact is almost identical with gum acacia (the gum arabic of commerce). This gum was brought to notice as long ago as 1854, by Dr. Shumard, of the United States army. It has for some time been kept in the drug stores of the Mexican cities, and considerable quantities have been sent to San Francisco from the Mexican ports of the Pacific. During the past year it has become an article of export, some 12,000 lbs. having been gathered in Bexar county, Texas, and as much more between that and the coast.

The mesquite (or, as it is sometimes called, mosquit) is the Mexican name for a leguminous tree belonging, like the gum arabic producing acacia, to the suborder *Mimosa*. It is a tree growing from 30 to 40 feet in height, with a rounded head It bears, in its general aspect, a great resemblance to the common honey locust (*Gleditschia*); its leaves are twice-pinnate, and the leaflets narrow, somewhat curved, and an inch or more in length; the flowers are small, greenish-yellow, and crowded in dense axillary spikes; the pod or bean is from 6 to 9 inches in length, curved or straight, flattened, and constricted between the seeds.

There are several species of mesquite, but the one under consideration (*Prosopis glandulosa* of botanists) has the widest range, being found as far north as the Canada river, and extending south into Mexico; it appears in Texas not far from the coast, and is the most abundant tree as far west as the Colorado and Gulf of California. Were it not for the presence of the mesquite, immense tracts in Arizona and Northern Mexico would present greater difficulties to travelers than they do, since this tree affords the sole fuel and forage of the country. As fuel, the wood has no superior; it makes a fire almost as intense as one of anthracite. The pods or beans, which ripen in June, contain a sugary pulp having an agreeable blending of sweetness and acidity, somewhat like the harvest apple. They are very nutritious, and while their importance to the civilized traveler lies in their value as food for horses in districts destitute of grass, they are of still greater importance as articles of food to the Indians living within its reach. To whites the taste of the fruit is somewhat mawkish and unpleasant, but it is greatly relished by the Mexicans and Indians. The latter, when the pods are in a fresh ripe state, put them into a wooden or stone mortar and bruise them, then mix them with water and empty them into an earthen dish, where, after standing a few hours, there results a sort of cold porridge or mush. All present then collect around the newly prepared mess, and, sitting on the ground near the dish, scoop the food out with their hands without any ceremony, and without regard to distinction of rank, age, or sex. The nearly naked bodies of the Indians soon become smeared with the food from head to foot, and the shaggy appearance of their hair adds nothing to their aspect of cleanliness. The meal finished, their faces assume a complaisant look, while their tumid abdomens give abundant evidence of the quantity of food consumed.



THE MESQUITE.

The pods, as they ripen, are gathered for winter use; and, after being thoroughly dried, are stowed in cylindrical-shaped baskets, made of twigs, and covered with mud and grass to keep out rain. In this shape they can be preserved for a long time. They are among the great luxuries of the Apaches, Pimas, Yumas. Maricopas, Mohaves, Hualipais, Cocopahs, and Moquis, of Arizona, besides of many tribes in New Mexico, Utah, Nevada, and the southern portion of California. The squaws pound the dried pods until reduced to a fine powder, which, being mixed with a little water, is pressed into large thick cakes weighing several pounds, and these being dried in the sun are afterward used as circumstances require. The pods are also often kept in the powdered state in bags; but if the beans are not pulverized as fine as the pulp they soon become a living mass, since from every bean will issue a weevil, a species of *bruchus*. To the Indians, however, this is a matter of indifference; and they never trouble themselves to pick the insects out, but allow them to become an ingredient of the bread. If reduced to a fine flour the insect larva becomes a part, forming a homogeneous mass of animal and vegetable substance. The flour being very sweet, forms, when mixed with water, an agreeable drink; boiled in water and fermented, there results a pleasant and nutritious beverage, held in great esteem by the natives. The bark of the tree is utilized by the Indian women for making skirts, and it is also twisted into ropes or twine, and even woven into baskets.

The gum which exudes spontaneously from the bark of the tree is described as very similar in its properties to gum arabic, and an analysis by Dr. Morfit has shown that in composition and chemical properties it very closely resembles the latter. As it oozes from the bark it concretes into tears and lumps of various sizes, which vary in color from pale yellow to dark amber. It is very brittle, easy to pulverize, and its fractured surfaces are brilliant.

The natural exudations from a single tree vary from an ounce to three pounds, but doubtless much more would be yielded were incisions made in the bark. The branches are said to furnish a purer quality than the trunk. The gum, when perforated by insects, is often eaten by the Indians. All the tribes of Arizona mix this exudation with mud, which is then daubed over the head, thus serving two purposes—killing parasites, and rendering the hair dark and glossy. As the mesquite trees abound upon the plains over regions thousands of miles in extent, and flourish luxuriantly in dry and elevated situations, the gum must, in course of time, become an important commercial article when the facilities for gathering it become more perfect.

The Law in Respect to Small Steamboats.

In view of the large number of small steamboats and launches now in use throughout the country, the following information respecting the requirements of the law concerning their construction, engineering, etc., will doubtless prove useful. This information has been furnished by the Supervising Inspector General of Steamboats of the Treasury Department, Washington, and is from a decision made by the Department, July 3, 1875.

Under section 4,426, Revised Statutes, the hull and boiler of every yacht, or other small craft of like character propelled by steam, must be inspected—the boiler being subjected to the hydrostatic test required by law. The pilot and engineer must also be licensed; and such other provisions of the law complied with as may be applicable to the particular vessel under examination.

Sections 4,428 and 4,431 require that the iron or steel plates of which the boiler is constructed must be stamped with the name of the manufacturer, the place where manufactured, and the number of pounds tensile strain it will bear to the sectional square inch.

The boiler must be provided with such appurtenances as are necessary to its safe management, namely: Feed pump and check valve, steam pressure gauge, safety valve, gauge cocks, a water gauge (showing the height of the water in the boiler), and blow off valve; and, if it is found applicable to the kind of boiler employed, a tin plug, so inserted that it will fuse by the heat of the fire when the water in the boiler falls below the prescribed limit.

There must be on board the means of applying the required hydrostatic test.

For so small a vessel as you describe (26 feet long), four buckets kept on board will be sufficient means for the extinguishment of fire.

There must be provided for each person on board a life preserver containing at least six pounds of good block cork, adjustable to the body in the manner of a belt or jacket, with shoulder straps.

The fee for license as "special engineer" for this yacht, which will be granted to any person of good character. who has sufficient experience to manage the boiler and machinery safely, is five dollars. A similar "special license" as pilot for this vessel will be granted to any person of like good character who is familiar with the navigation in which she is to be employed, understands the pilot rules, and has had sufficient experience in handling this or other similar vessels.

The master of a vessel of this class does not require license.

A steam whistle of suitable dimensions must be provided, with which the pilot will make the signals as required by the pilot rules above referred to.

When the equipment is completed and the vessel is ready for inspection, it is required that application shall be made in writing by the master or owner to the local inspectors within whose district the vessel is owned or employed.

New Engineering Inventions.

Mr. George W. Dixon, of Spring Lake, Mich., is the inventor of an improved Valve Movement for Direct-acting Steam Pumps, by which the noisy tappets and the expense for the same are dispensed with, and a smooth, positive, and reliable motion is given to the valve. The valve will always move with perfect accuracy, and dispense with an auxiliary valve.

An improved Packing for Oil Well Casings has been patented by Mr. John Q. Miller, of Emlenton, Pa. This is a packing for the casing of oil wells at that point where the oil well is continued downwardly at a less diameter than in the upper part of the well hole, the packing being so arranged that the weight of the casing produces the tight closing of the well hole at that point, so as to positively exclude the water and be not affected by the concussion of torpedoes, or by the jarring of the tools while drilling inside of the casing. The packing also admits of the easy pulling up of the casing without producing the turning of the packing.

Mr. John H. Gable, of Shamokin, Pa., is the inventor of an improved Condenser for Steam Engines of all kinds, in which a current of water is employed to condense the exhaust steam, and create thereby a vacuum that facilitates the running of the steam engine or pump, and gives it a greater percentage of power.

Mr. Sanford Hazen, of Ripon, Wis., has patented an improved Wind Engine, in which the vane is placed in such position to the wheel and tower that the mill may not be wrecked by the reaction of the wind, and in which the speed of the wheel may be regulated automatically or to any desired degree, the wheel being so constructed that any wing of the same may be readily removed and replaced with great facility for repairing or other purposes.

An improved Balanced Slide Valve has been patented by Mr. Walter R. Gluya's, of Cerro Gordo, Ill. This invention relates to the class of engine slide valves known as balanced valves; and it consists in the construction and arrangement of the parts of the valve and ports and passages in the valve chest and cylinder, whereby the valve is relieved from pressure and friction, so that little power is required to move it.

Mr. Joseph S. Badia, of Philadelphia, Pa., has patented an improved Automatic Feed water Regulator for steam boilers that accomplishes three different objects at the same time, namely, to indicate the height of the water level in the boiler, to give a whistle alarm when the water level is either too high or too low, and, finally, to act as an extractor of the air accumulating in the feed pump.

Mr. William Y. Rohrbach, of Kribb's Farm, Pa., has patented a Cover for Casing Heads of Oil Wells, in which the guide hole for the tubing is made with an outward taper or flare toward the upper and lower edges of the hole; and it consists, secondly, in a cover with two top lugs for preventing the clamps or elevators from spreading.

Mr. William Irelan, of Oak Springs, Iowa, has devised an improved Truss Bridge, that is made of a number of connected sections, the braces of which are so attached to each other as to be readily removed individually and repaired, when required, without the use of a trestle below the bridge.

An improved Compound Steam Engine has been patented by Mr. Albion Vile, of Southampton, England. This invention relates to improvements in compound engines of that kind in which the piston of the high pressure cylinder is made to act as the valve to open and close the ports leading from the high pressure to the low pressure cylinder or cylinders for controlling the passage of the steam from the one to the other. The steam, after it has acted on the piston of the high pressure cylinder, is passed directly into the low pressure cylinder or cylinders without the intervention of any slide valve between the cylinders, and without exhausting into jackets or receivers of any kind.

A Smoke Consuming Furnace.

The plans proposed and tried for consuming all smoke under boilers are as countless almost as are the boilers in use, for every engineer and every fireman of a few years' experience has his pet theory and practice on the subject, and yet boiler smoke stacks continue to pour out volumes of smoke, to the annoyance and discomfort of their neighborhoods.

It is well and widely known that fuels are consumed with the greatest possible economy when all of their combustible products enter into combination with enough and no more atmospheric air than is needful to supply the combining oxygen; and as a product of this knowledge we have the various practices of introducing air into the fireplace, and at other points along the combustion flue, to mingle with and consume the smoke and gases. Excepting in very rare instances these methods fall far short of effecting the purpose for which they were designed, for the reason principally that the cooling effect of the air has not been sufficiently considered. In the most successful cases the air is made to circulate through the heated walls of the boiler furnace before it is introduced into the combustion flue to mix with the unconsumed gases and smoke, and to the recognition of this fact we owe a recent invention, which designs to place a fire at each end of the boiler, and to alternately pass the smoke and gases from the one fire, as it receives a fresh charge of coal, over the other, which is in a state of full combustion.

According to another plan of some merit, several bridges, alternating with narrow arches thrown up nearly in contact with the under surface of the boiler, are arranged along the combustion flue, with the effect of producing a more intimate mingling of the air and gases by frequent deflections and disturbances of the current, and of increasing the heat radiating surfaces.

But all the conditions requisite for complete combustion are not secured simply by a mingling of the smoke, unburned gases, and atmospheric air, no matter how thoroughly this may be done; for it must be borne in mind that all of the boiler surface exposed to the flame is constantly absorbing the heat thereof to an extent that rapidly cools the burning gases to a point at which their combustion ceases, and unburned carbon or smoke is deposited or produced, and that this is the chief cause of trouble even when the firing is most skillfully done.

The question then seems to be, Can economical and complete combustion be secured before the gases are brought in contact with the heat absorbing surface of the boiler?

Every one has observed that highly heated furnaces in rolling mills give forth no smoke unless it be for an instant, when fresh coal is thrown on the fire; and the reasons for this are that an abundance of air is always given to the fuel which lies thickly on the grate, and that the temperature is maintained by the heat radiating interior surfaces of the furnace at the combustion point of the gases.

We readily admit that it would not be possible or economical to supply all boilers with a furnace attachment simply for the purpose of securing perfect combustion, but the correctness of the principle of supplying additional heat radiating surfaces to boilers cannot be questioned, and it has, to our knowledge, been applied in more than one instance in a very simple manner and with complete success.

In these instances the grate surface has been slightly narrowed by building up on each side of the fireplace thin walls of fire-brick extending three or four feet back from the feed door, and from these walls a rather flat fire-brick arch has been thrown over the whole grate surface—the crown of the arch reaching to within an inch of the crown sheet of the boiler—thus practically forming, within the combustion flue or flame space of the boiler, a reverberatory furnace, which an hour's firing raises to a white heat.

Each fresh supply of coal required is thrown just within the fire door, which is then quickly closed, and pushed forward and leveled with a light tool introduced through a register in the door; in this way any great access of cold air to the combustion chamber is avoided, while a gradual presentation of fresh coal to the fire is secured.

The radiation from the fire surface and heated side walls and arch forms a focus of intense heat which insures a proper temperature to the admitted air and complete combustion of the smoke and gases before they come in contact with the boiler; and consequently there is no escaping smoke, while there is nearly perfect utilization of all the products of combustion.

At first thought it might be objected that as the crown sheet of a boiler is the most effective heat absorbing surface, it being ordinarily exposed to the direct heat of the fire, whatever interferes with this action must be false practice; but further consideration will convince that the heat radiating arch secures a more even temperature about the whole boiler, and at the same time protects the crown sheet from the usual excessive wear or deterioration, thereby prolonging the life of the boiler, and that all of the heat excepting what is utilized for the draught must do the work for which it is intended.

It will be evident that by this thorough combustion, a very considerable saving in coal must be effected, and that, in many instances, a cheaper quality can be used, while the deposit of non-conducting matter in flues and tubes will be reduced to a minimum. The character of the coal used chiefly determines the proper length for the arch; very fat bituminous coals requiring an arch of from four to six feet, while a length of from three to four feet will, in most cases, be sufficient to secure the desired result.

Undoubtedly correct in principle—substituting heat radiating for heat absorbing surfaces at the fire end of the boiler—this plan should meet with general acceptance and relegate to the past the long endured smoke nuisance.

Natural History Notes.

Influence of Electricity on Plants.—Some interesting experiments as to the influence of atmospheric electricity on the nutrition of plants have lately been made by M. Grandean, and communicated by him to the Academy of Sciences, of Paris. He placed two plants of the same species (tobacco, maize, wheat) under the same conditions as to soil, aeration, isolation, etc., but the one withdrawn from the action of atmospheric electricity by means of a Faraday's cage. The plants thus withdrawn elaborated, in equal times, 50 or 60 per cent less of living matters than the others. Plants of small elevation above the ground are also affected by atmospheric electricity. The centesimal amount of proteic matter formed appears not to depend sensibly on this action; it is proportional to the yield. The proportion of ash is higher in plants removed from the electricity, and the proportion of water is less. The French scientist, however, does not explain why it is that two plants of the same species, growing in a field side by side, and under the same conditions, do not always attain the same development nor elaborate the same amount of material from the soil.

Tropical Butterflies.—Mr. Wallace, in his recent volume ("Tropical Nature"), destroys some of the illusions of those who have never traveled in the tropics, as, for example, that the flora of these latitudes presents a dazzling brilliancy of color. On the contrary, foliation is the most prominent feature, and a conspicuous mass of blossoms, when occasionally met with, forms merely "an oasis of color in a desert of verdure." The next most general characteristic of a tropical forest is the apparent absence of animal life; for although an immense variety of forms is actually present, they are so widely scattered and shy as to require careful search to detect them. This, too, was the experience of our American explorer of the Amazons, the late Professor Orton. A striking exception to this rule, however, is presented in the case of the butterflies, which are not only numerous, but extremely conspicuous from their size and gorgeous coloring. Of these the author says: "Their aspect is altogether different from that presented by the butterflies of Europe and most temperate countries. A considerable proportion of the species are very large, six to eight inches across the wings being not uncommon among the *Papilionidæ* and *Morphidæ*, while several species are even larger. This great expanse of wing is accompanied by a slow flight; and, as they keep near the ground and often rest, sometimes with closed and sometimes with expanded wings, these noble insects really look larger and are much more conspicuous objects than the majority of our native birds. The first sight of the great blue *Morphos* flopping along in the forest roads near Para, of the large white-and-black semi-transparent *Ideas* floating airily about in the woods near Malacca, and of the golden-green *Ornithopteras* sailing on bird-like wings over the flowering shrubs which adorn the beach of the Kè and Aru Islands, can never be forgotten by any one who has a feeling of admiration for the new and beautiful in nature."

The "Poison Upas" Tree.—Among the numerous fictions regarding the animal and plant world that still go to form the staple of "popular science" compilations for the village library, that regarding the pestiferous exhalations from the "poison upas" is prominent. The erroneous and exaggerated statements respecting the upas tree (*Antiaris toxicaria*) are due to a Dutch surgeon, Dr. Foersch, who circulated them about the close of the last century. The tree was described as "growing in a desert tract, with no other plant near it for the distance of ten or twelve miles. Criminals condemned to die were offered the chance of life if they would go to the upas tree and collect some of the poison. They were furnished with proper directions, and armed with due precaution, but not two out of every twenty ever returned." Dr. Foersch states that he obtained his information from some of the survivors who had been lucky enough to escape, although the ground was strewn with the skeletons of their predecessors; and such was the virulence of the poison that there are no fish in the waters, nor has any rat, mouse, or other vermin been seen there; and when any birds fly near the tree, so that the effluvia reach them, they fall dead, a sacrifice to the poison. These statements having been quoted by Dr. Darwin in his "Botanic Garden," were thence disseminated through Europe.

The upas is a tree often attaining a height of over 100 feet, and found native in the islands of the Indian Archipelago. The stamens and pistils are found on separate flowers on the same tree, or, botanically speaking, the plant is *monœcious*. The tree belongs to the natural family *Artocarpaceæ*, the plants of which almost all abound in juices that are deleterious to a high degree; although it includes many that are extremely useful to man in many ways, among these, for instance, the famous cow tree, which yields a rich and wholesome milk; the *Ficus Indica*, which produces gum shellac; *Ficus Carica*, producing figs; *Morus*, or mulberry tree, etc. The upas tree, when pierced, exudes a milky juice which contains an acrid virulent poison, called *antiarin*. This, when dried, forms a poison in which the natives dip their arrows. As specimens of the tree have long been cultivated in botanic gardens, the reports regarding its venomous exhalations are known to be as erroneous as those will be some day that at present ascribe to *Eucalyptus* the power of emitting febrifuge exhalations.

The mistaken notion that long connected this noxious property with the upas arose from the fact that the tree occasionally grows in certain low valleys, in Java, rendered unwholesome by an escape of carbonic acid gas from crevices in the ground, and emitted in such a quantity as to be fatal to animals that approach too closely. These poisonous valleys are connected with the numerous volcanoes of the island. According to Reinwardt, sulphurous vapors are given off in such abundance from the craters of some of these volcanoes as to cause the death of a great number of tigers, birds, and insects; while, in some cases, the rivers and lakes are so charged with sulphuric acid that no fish can exist in them. The upas tree, therefore, although there is no doubt as to its inherent poisonous nature, has had to bear the reproach really due to volcanoes and their products.

Fecundity of the Queen Bee.—Baron Berlepsch, in several different experiments made to find out how many eggs are daily deposited by the queen bee, discovered that she laid 1,604 eggs in twenty-four hours, as the result of the first. In the second, she deposited on an average 1,913 daily, for the space of twenty days. In the third one, an average of 2,400 daily was found for the same length of time. In the fourth, she deposited 3,021 in twenty-four hours. She was seen by him to deposit 6 eggs in one minute. A writer in the *National Live Stock Journal* states that a gentleman told him, at the Illinois State Fair, that he had known a queen to deposit an average of 3,800 eggs daily for several days. As to his own experience, he had known 1,500 eggs to be deposited within the short space of four hours.

The Ascent of Sap.—A theory as to the rapid ascent of sap in the tissues of plants has recently been brought forward by M. J. Boehm. It is based upon the elasticity of cells. He states that "when the surface cells of a plant have lost a portion of their water through evaporation they are somewhat compressed by the air-pressure. Like elastic bladders, however, they tend to resume their original form, which is only possible by their taking in air and water from without. Since moist membranes are little penetrable by air, the outer cells draw from the cells which are further in a portion of their liquid contents. These, in turn, borrow from their neighbors further down, which contain more water, and so on, either to the extreme root cells or to those parts of the stem which are supplied with water from below through root pressure."

The Migrations of a Parasitic Worm.—Among the hosts of animal forms that live as parasites on or in other animals, there are certain worms which are free when young, and become parasites only at a later period of their evolution. For example the Guinea worm (*Filaria medinensis*) is the terror of travelers who visit the coast of Guinea; it is not only common on the west coast of Africa, but has recently been found in Turkistan and South Carolina. This worm undergoes its final development in the subcutaneous and intermuscular cellular tissue of man, and attains a length of 12 feet. It has been ascertained that the parasite, as a microscopic embryo, is transmitted by means of the cyclops, a little fresh water crustacean. In 1824, Deslongchamps discovered in the fatty matter of the common cockroach a great number of small lenticular bodies visible to the naked eye, to which he gave the name of *Filaria rytipleurites*. This encysted worm represents simply the asexual state of a nematoid whose migrations up to the present time have been unknown. *Les Mondes* gives place to a note from M. Osman Galer, who has traced the history of the parasite. He states that he made use of rats, which he fed on cockroaches infested with the parasites. At the end of eight days, having killed the three rats put to the experiment, he found in the mucous membrane of their stomachs the nematoids in question, living, and free from their envelopes. In one of the rats he found three females and a male, all of which had acquired their reproductive organs. Thus is accomplished the last stage of their evolution. Impregnation takes place in the digestive tube of the rat, and soon after the eggs which are laid pass out with the fecal matters. These eggs are swallowed by the cockroach; the embryos hatch out then in the digestive tube of the insects, pierce its walls, and encyst themselves in the fatty matters to wait till the cockroach is in its turn eaten by the rat, in which it is to finish the cycle of evolution.

The Sago Palm (*Sagus rumphii*) often forms great forests upon the islands of the Indian Ocean and Moluccas, and is there easily propagated by suckers. The white inner part of the stem, thickly permeated by bundles of fibers, abounds in a marrowy substance, which, when baked into bread, furnishes a daily food to the inhabitants of most of the southern and southeastern parts of Asia. This, in the form of flour and granules, is widely distributed in commerce under the name of "sago." One trunk of the age of fifteen years will sometimes furnish 600 lbs. of sago. A similar use is made in the same countries of the mealy sago palm (*Sagus farinifera*). In this connection, too, we may mention the Mauritius palm (*Mauritia flexuosa*), which, on account of its pithy stem, containing a sago-like meal before flowering, is also called the sago palm of South America. It grows from the mouth of the Orinoko to the Amazons, and also in Central America; and the mealy pith serves the Indians of these countries as a chief article of food.