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Rizal and the Progress of the Natural Sciences

J. P. BANTUG

Deber nuestro será seguir los áridos pero productivos senderos de la Ciencia que conducen al Progreso.—Rizal

ACCUSTOMED to a life of activity from early youth, heightened by his sojourn abroad among a more aggressive people, Rizal made a firm resolve to so employ his time thenceforward as to profit by every tick of the clock. To this end, he laid out a program of daily work: so much time for study, so much for recreation, and so much for sleep, so that he had not a moment but was devoted to some useful purpose. He voluntarily kept himself away from the gay places to which the young men of his time resorted. He seldom attended theatrical performances, and did so only if a play of the classical type was on the stage, as when he recorded in the diary he kept in Madrid, while a student at the Central University (24 April 1884): "Esta noche he visto representar Hamlet por Rossi. He pasado un rato muy agradable al ver cuán magistralmente se interpretaba a Shakespeare."

Rizal was an omnivorous reader. To him it became a passion to own books. This was the heaviest item of his expenses while abroad, as recorded in his diaries and in his letters. A gift of a book was most welcome to him. In time, he was able to form a good-sized working library of some 2,000 titles, written

in several languages, of which he was proficient in no less than 25, including several of the Islands' principal dialects. What was left of the library, later acquired by the Philippine Government, unfortunately perished during the War. Each volume showed long and frequent handling, albeit well preserved, as he was careful to secure only editions with good leather bindings or ordered them well bound and in some cases did the bindings himself, as shown by the original of his masterpieces the *NOLI* and the *FILI*, which have been preserved for posterity.

It was, therefore, with some misgivings that he left for his exile in far-away Dapitan in July, 1892. Nevertheless, he made an honest effort to be useful to his people there. He plunged heart and soul into more than half a dozen undertakings. In several of these he made substantial contributions to the progress of natural history, so much so that his European colleagues and admirers, in recognition of his accomplishments, gave the surname *Rizali* to at least three species, a beetle, a toad, and a flying dragon, hitherto unknown to the world of science.

We may judge of Rizal's state of mind soon after his arrival in Dapitan, that bit of Northern Mindanao which was thereafter to be associated with his name, by what he wrote to a friend: "I was greatly bored without books or periodicals to read. I had not even the desire to write. I had no friends or acquaintances."

Soon afterwards, however, he adapted himself to his new surroundings and came to like the place, because the climate suited him better than that of his native Calamba, and much better still than that of Manila. As he himself wrote to his friend, the Czechoslovakian savant, Professor Ferdinand Blumentritt, "I am now much nearer to nature. I hear constantly the murmur of the waves and the rustling of the leaves and see the palms waving and swaying in the gentle breeze."

He delved into the secrets of the plant and animal life of the region and made notable contributions to the progress of science. Horticulture was the first avocation to which he turned his attention. In less than a week after his arrival he planted over 500 pineapple crowns in the lot adjoining the government

house (where he was temporarily lodged), besides a number of banana plants and a few coconut trees. The fact that he did all this without assistance suggests that he must have been endowed with the kind of bodily strength which we do not ordinarily associate with any of the learned professions. Undoubtedly, the methodical exercise to which he subjected himself, after having recovered from what he suspected to be incipient tuberculosis, so hardened his muscles as to serve him here in good stead. In fact, it was well known among his friends that in spite of his relatively small stature, about 5' 4", he had an extraordinarily well developed physique. This unusual strength so impressed Luna, the artist, that he made Rizal his model for Chief Sikatuna in his painting, "The Blood Compact", that now adorns the Hall of Ambassadors of Malacañang Palace.

As the days went by, his pleasing personality and ready obedience to the rules that had been laid down for him so won the confidence of the Commandant, Don Ricardo Carnicero, that he was allowed greater freedom. He was permitted to go about the locality unaccompanied by a guard, sometimes for days at a time. On one of these walks at the outskirts of the town, he found a pretty spot by the seashore which he was able to buy for a paltry sum. He made a clearing where he built a thatched bamboo hut, so feelingly described in the poem he wrote afterwards:

Cabe anchurosa playa de fina y suave arena,
Al pie de una montaña cubierta de verdor,
Planté mi choza humilde bajo arboleda amena,
Donde día y noche la arulla el mar.

He proceeded to convert the place into a small mixed plantation of coconuts and other fruit trees and in time reaped great returns from his small investment. "Paso mis días de un lado a otro, cuidando enfermos, sembrando, etc.," he wrote to a friend. He also tended an abaca plantation and dedicated himself to its improvement. Rizal's foresight in this regard was borne out by later planters who found the rich soil of Mindanao peculiarly suited to several of the Philippines' most important crops. Witness the extensive abaca plantations developed by the

Japanese before the last war and the extensive coconut groves planted by immigrants from Luzon and the Visayas which have made that great island a veritable "land of promise".

Rizal studied with his pupils the economic and medical botany of the region, in a manner not unlike that of the ancient peripatetics of the Greek Academy, with the difference that instead of conducting the recitations while walking, Rizal did so while reclined in a hammock hung under the cool shade of millenary trees. With Father Francisco de Paula Sánchez, S.J., of the Ateneo, one of the preceptors of his student days, he formed a good-sized herbarium and noted the characteristics of each species—whether it was medicinal, decorative or useful for building purposes. Naturally, what he left in this respect were mostly scattered notes in a small notebook which the good Padre preserved with loving care for many years. Nevertheless, he was able to prescribe for his patients, the majority of whom were poor and unable to pay for medical service, certain medicinal plants for the treatment of the commoner diseases of the locality.

One of the *Agathes* species Rizal found to be a good source of resin, an important material in the world industry of varnish making. A species of *Palaquium* of the mangrove family he found to be a good source of paste, which the Philippine carpenter of long ago made use of in ship-building and in cabinet-making, as related by Father Juan José Delgado, the Jesuit historian of the mid-eighteenth century. The formula for its preparation had been lost entirely in the course of time, and it was left Rizal to rediscover the method of preparing it. With this *bakhaw* plastic material Rizal was able to mold ornamental tiles, objects of art and household utensils. When hardened, this paste possessed very striking qualities: first, in its being waterproof, second, in its being fireproof, and, third, in its being very light. Had Rizal been allowed greater opportunities what could he not have done with this new material? Surely we may justly count him as a forerunner in the field of plastics, which because of its far-reaching possibilities is now revolutionizing the world of industry.

Another notable botanical discovery of Rizal in Dapitan was the discovery of a new species of *ilang-ilang*, the *Canarium odoratum*, a native of the Philippines. It should be noted in this connection that the manufacture of the essential oil of *ilang-ilang*, an important element in perfume making, was a thriving industry in the Philippines sixty years ago, and formed quite a bulk of our exports. With the appearance of synthetic products in the world's markets, the cultivation of *ilang-ilang* trees has been abandoned so that it is no longer an article of commerce.

Since he lacked the necessary instruments and chemicals, it was obvious that Rizal could not undertake extensive investigations in the realm of pharmacology. The preparation of the *bakhaw* plastic, however, shows that he could rise to the occasion when pressed, and the notes which he made on several medicinal plants found in the locality as to their therapeutic properties qualify him as an original investigator of no mean stature. Among the tubers investigated by Rizal was one that goes under the common name of *namí* (*Dioscorea hispida*). This is an edible tuber when properly prepared, but oftentimes causes poisoning because of its lethal alkaloid content, dioscoreina, if one is ignorant of the secret of its preparation. Rizal's process was to make thin slices of the tuber, place them in a wicker basket, and let them soak in running water in a nearby stream. He observed the contents of the basket from time to time and when, after several days, he found small snails adhering to the slices, that indicated to him the right time for withdrawing them from the water. They were then ready for the kitchen. The Tagbanuas of Palawan have their own way of preparing edible *namí*: by curing the slices in the sun. The poisonous dioscorine content of the tuber is thus volatilized.

In the field of entomology, Rizal made some notable contributions, enriching not only the museum of his Alma Mater, the Ateneo Municipal de Manila, but also those of Dresden, Frankfort-on-the-Main, Prague, and other private collections. To the Royal Museum in Dresden, of which his friend, Dr. A. B. Meyer, one of the advisers to the Royal house of Saxony, was Director, 240 insects were sent by Rizal between the years 1895

and 1896, among them those hitherto unknown species which were named after him. A five-horned beetle was among these discoveries. Had he stayed longer in Dapitan, what would he not have done with the abundance of materials around him!

Rizal was familiar with the anopheles mosquito, some 20 species of which have been identified in the Philippines. However, only one, the *anopheles minimus*, var. *flavirostris*, has been scientifically determined by C. Manalang of the Bureau of Health, a determination subsequently confirmed by A. Ejército and other investigators, as the principal, if not the only vector of malaria in the Islands. Rizal's draining of the swampy places in the locality showed his keen good sense as a practical sanitarian.

Following the trend of his scientific investigations, he traced the life history of a most destructive insect pest, the *Chalcosoma atlas*, native name *uwang*, the common coconut borer, and also studied the common rice out-worm, the *Leptocurisa acuta*, familiar to rice growers of Central Luzon under the name of *aksip*, of which there are two varieties, the white (*aksip na puti*) and the reddish-brown (*aksip na pula*). We may note here that a subspecies of mosquito of the Genus *Finlaya* was named after Rizal by its discoverer, the noted American entomologist, Dr. Charles S. Banks.

But his most important contributions in the whole range of his scientific endeavors were to local conchology, the extraordinary richness of which had long been known since the researches of Hugh Cuming, 65 years before his time (1837), brought forth more than 2500 different marine species and some 600 of the land shells: the result of over four years of travel through the Archipelago. The next important contribution to local conchology was made by C. Semper, who in the years 1859-1860 especially dedicated himself to the study of Philippine *mollusca*. Other foreign scientists followed suit, the most notable among them being Jagor and Drasche, who made substantial contributions to Philippine malacology.

In 1895 Fr. Castro de Elera, O.P., brought out his CATÁLOGO SISTEMÁTICO DE TODA LA FAUNA DE FILIPINAS, listing some

7000 species of Philippine *mollusca*, largely represented in the collection of the University of Santo Tomás Museum. No work of similar breadth has since been written. Dr. Leopoldo Faustino who could have written a very exhaustive treatise on the subject was able to publish only his researches on *madrepore*.

According to Jordana y Morera in his BOSQUEJO GEOGRÁFICO E HISTÓRICO-NATURAL DEL ARCHIPIÉLAGO FILIPINO (Madrid, 1885), p. 322, "La fauna malacológica de las Islas Filipinas es una de las numerosas y variadas del universo;" and he adds, "imposible encontrar reunidas en cualquiera otro punto del globo especies tan notables, por su tamaño, formas y coloración como los que ofrecen las posesiones españolas de la Oceanía" (p. 323). The *Tridacna Gigas*, for example, the common *taklobo*, may attain a shell measurement of 120 cm. and more, and weigh a good many kilos.

That Rizal tried to write a formal treatise on shells may be deduced from an unfinished 5-page manuscript, the original of which was in the possession of one of his nephews, Dr. Leoncio López Rizal. He had already written on the *Cephalopods* of his collection and had made a beginning on the *Gasteropods*, when for some unexplained reason the manuscript ended abruptly. He had collected in and around Dapitan nearly three hundred and fifty species, 346 to be exact, as the catalogue of his collection, written in his own hand, shows, and as the collection itself, still intact, attests. A set of duplicates was sent to the Ateneo and Padre Joaquín Añón, Professor of Zoology and Curator of the Museum, was most appreciative, as they considerably enlarged his shell collection. The classification of the rarer species was entrusted to Padre Sánchez, Rizal's beloved professor, and the well known Spanish conchologist, Don José Florencio Cuadras of Manila. The still rarer species were sent to Europe to be classified by specialists, like Don Joaquín Gonzales Hidalgo of Madrid, whose authority in this line was recognized the world over. Some of the more interesting varieties in Rizal's collection are the *Sollicitus filipinarum*, *Arca luzonica*, *Lucina filipinarum*, *Rissoma comingi*, and an unclassified bivalve from Talakiton,

near Dapitan. However, the much coveted *Conus Gloria Maris* is not in the collection, although the first specimens were discovered by Cuming on the island of Bohol, north of and not far from Dapitan.

More significant still to Philippine science was Rizal's discovery of several new species, more than half a dozen in number, which were named, one after Padre Sánchez, another after Sr. Cuadras and a third after Sr. Hidalgo. Of these new species, three were sea-shells and one a land-shell, a snail. A fine colored drawing of the latter has been preserved among Rizal's note-books. Dr. Faustino, the foremost Filipino authority on conchology, became interested in Rizal's discoveries and expressed the hope of making a detailed study of the collection, but death overtook him before he could accomplish his wish.

Rizal took the course in natural history prescribed in the fourth year of the bacchalaureate course in the Ateneo Municipal. He was conversant besides with the CURSO DE HISTORIA NATURAL of Fray Ramón Martínez Vigil, O.P., former Director of the Museum of the University of Santo Tomás and later Bishop of Oviedo in Spain. He was therefore more than sufficiently prepared to deal with the taxonomy of the subject, as shown in his listing of the commoner species as they began to accumulate in his collection.

The collection was kept, carefully arranged, in a wooden box—an empty A V H Gin container. Outside of the immediate members of the family, I was probably the first person privileged to examine its contents after the box was brought up from Dapitan. The box was first deposited in the house of Rizal's elder sister, Doña Narcisa, on Calle Estraude (Binondo), but it was in Doña Trining's residence on Calle San Fernando, early in 1911, that I had the opportunity to examine it. The shells were arranged on about 8 trays, divided into small compartments of 2" x 2" containing two, sometimes more, shells in each. The identification of each species was written on a small piece of paper folded and tucked into the

shell. The box has since been renovated and fitted with a padlock, but the trays are those originally fashioned by Rizal.

Rizal was responsible for introducing to Dapitan fishing nets like those used in Manila Bay and in his native Laguna de Bae, as well as for the construction of fish corrals, the use of which was then unknown to the inhabitants of the locality. In the early morning hours he loved to watch the fishermen lift their nets from the water. He would select the less common varieties and those with brilliant hues, and draw them, at the same time writing a brief description of the characteristics of each, and giving their local names. His facile pen must have caught the salient features of each species, because Dr. Albert Herre, an authority on fishes and formerly head of the Division of Fisheries of the old Bureau of Science, was able to identify all but one of the 38 different species depicted and give each its scientific name.

Rizal contributions to local anthropology and ethnology were likewise notable. Upon his admission to the Anthropological and Ethnological Society of Berlin, sponsored by no less a member than its President, Dr. Rudolf Virchow, the Father of Cellular Pathology and the foremost sanitarian of his time, Rizal read in German an original paper on Tagalog poetry, *Tagalische Verkunst*, which was later published in the transactions of the Society. Moreover, he translated into Spanish some of the works of Blumentritt in German, such as "La Et-nografia de Mindanao" y "Amplificación a Mi Mapa". His "Specimens of Tagalog Folklore" and "Two Eastern Fables" have been commented on favorably by scientists of world-wide renown. H. Kern, an outstanding Dutch orientalist of his day, discussed the last work in one of the sessions of the International Congress of Orientalists held in Stockholm, Sweden, in 1897.

In one of his letters to Dr. Meyer, Rizal suggested that it would be interesting and useful to make a study of the races of Mindanao. He was anxious to regain his liberty in order to live for some weeks among the Subanos and Moros of the Islands, and he wrote exultantly on another occasion to his

friend that "I have a good collection of *cranea* for the study of local anthropology." To the museum of Dresden he sent one instrument for venesection, one *kampilan*, one bronze platter, three wooden spoons, and two wooden forks. With Padre Sánchez, he made a relief map of Mindanao in the town plaza of Dapitan. Their original plan was to model the entire map of the Philippines, in relief, as a practical aid to the study of Philippine geography. For this purpose, the square was divided into eight parts, but it was only that of Mindanao, covering an area of about 20 square yards, that was completed. It took them two whole months to finish the work, as it was necessary to bring earth and clay from other districts. From original surveys and explorations and with the further help of Brothers Tillot and Costa, both of the Society of Jesus, they were able to correct a number of errors in the existing maps of the time. Rizal was not a stranger to the task, as he was a graduate of the Ateneo with the title of *Agrimensor y Perito Tazador de Tierras*, and had won, moreover, all the prizes given in the subjects of topography, agriculture, and drafting.

With Padre Sánchez, Governor Carnicero and Padre Obach, Rizal made an exploration of the neighboring Limanon Hill. With that thoroughness so characteristic of him, Rizal, upon leaving the *población* of Dapitan, noted in a small notebook the different kinds of vegetation they found, the water courses they crossed, and the different species of animal life that happened along. His notebook was replete with observations of this sort.

It is a historical fact that the cave at Limanon was at one time the hiding place of Doña María Uray, daughter of the founder of Dapitan, Pagubayan, and herself the wife of Pedro Manook, a powerful chieftain of the island of Bohol. Upon the death of her husband, Doña María went back to Dapitan with her children and sought refuge in this cave, because she had spurned the advances and thus won the enmity of the powerful Sultan of Sulu, who sought her hand in her widowhood. The approach to the cave was defended by a stone wall,

dating back to pre-Spanish days, and the top of the hill was apparently an old burial ground of the early Christian converts, as slight digging uncovered sherds of old porcelain dating back to Sung and Ming times and also a bronze medal depicting on the obverse side the Virgin Mary seated and the Child Jesus on her lap, with another child in front, probably Saint John. On the reverse side of the medal was the image of Saint Francis of Assisi on his knees in front of a temple, receiving the stigmata. A crude gold ring with a ruby setting was likewise found. When Professor Carl Guthe of the University of Michigan made excavations on this site, he found a number of pieces of jewelry wrought in gold, chiefly in the form of beads of varied designs, while we had the good fortune to secure from the same spot a number of pieces of Ming porcelain that corroborate fully the genuineness of the finds of Dr. Rizal and his companions.

Of reptiles found in the locality Rizal must have had a very extensive collection, as besides those he sent to the Ateneo Museum, 45 were sent to Dresden, in addition to 9 mammals, 13 birds, 9 fishes and 68 crustaceans and other invertebrates. It should be recalled that three new species were found in the collection sent to Dresden and that they were named after Rizal, viz.: *Draco rizali*, a species of flying dragon, a specimen of which is found in the Museum of Arts and Sciences of the University of Santo Tomás and another in the National Museum, and described by Wandolleck; *Rachophorus rizali*, a hitherto unknown species of toad, found also in the National Museum and described by Boettger; and *Apogonia Rizali*, a small beetle, described by Heller.

All three are also represented in the Museum of Natural History of the Epifanio de los Santos College of Malabon, Rizal, prepared and mounted by its Director, Mr. Angeles de los Santos, and duplicate specimens were generously donated to the National Rizal Shrine at Fort Santiago in Intramuros (Manila). A small species of snake, not before classified, was also discovered. Alcohol was Rizal's usual preserving fluid for the smaller specimens, but his butterflies were packed in special envelopes.

Rizal's passion for collecting knew no bounds and sometimes when tied down with other work, he would complain, as he wrote to one of his friends, "I am so disgusted because I cannot have the time to go on collecting as I should like to." Withal, he devoted his whole soul to the work without expectation of monetary reward. Nevertheless, his European friends repaid him in a way with books on science, philosophy and literature, ancient and modern, and surgical instruments, chiefly those that he could use in his specialty, ophthalmology. The books were mainly either in German or Russian, among them being works by Gogol, Kranziewsky, Korolenchko, Danilewsky, Bismarck and Turgenjew. Upon the receipt of these books, he wrote to Dr. Meyer in a certain melancholy strain, saying, "Yo la remito la muerte naturaleza y Ud. en cambio, me envía su espíritu, el *Geist*, en las páginas de los libros."

Rizal doubtless chose the medical profession because, as he wrote once to his brother-in-law, Hidalgo, "Medicine is one of the most humanitarian of the professions." His work among the poor certainly proves his greatness of heart. Another special urge was the fact that his own mother was becoming blind and his utmost longing was to be able, through his specialty, to restore her eyesight, which he had the satisfaction to accomplish in later years.

In Dapitan he had many patients. In fact, not only those living in the locality came to him for advice and treatment, but people from the different provinces and islands as well. His well-deserved reknown attracted attention abroad, and an Englishman who was benefited by his skill gave him a fee of ₱500.00 which he spent for a public lighting system in the municipality, since it had none. But far his most notable work was in the field of public health in connection with sanitary engineering: the construction of a modern gravity water system. To collect the necessary building material for his dam, he suspended a piece of wood from the branch of a mango tree and challenged his pupils, at that time some twenty in number, to throw stones at it. Those who hit it were given prizes. In this way, he secured the necessary material for his dam, the outflow of which served to fill up a swimming tank.

The water was piped to his house through canals lined with fluted tiles (from ruined house-tops) and bamboo joints. He made a public fountain for the townspeople, quite a decorative piece of bricks and mortar, the water coming out of the mouth of a lion's head moulded in clay. For underground piping he employed the empty clay gin containers which abounded the locality, with the necks and bottoms knifed off, and joined end to end with mortar which he fabricated himself out of shells and coral from the neighboring beach. He made bricks from selected clay, either baked in the open or in small kilns which he fashioned himself. He was then able to produce up to 6000 bricks a day which were employed in building his dam. Years later, Mr. F. Cameron, the American Chief Engineer for the former Department of Mindanao and Sulu, after examining the works, marveled at the ingenuity of Rizal, who, with the scanty means at his command, had constructed a water system that was the first of its kind to be built in the islands after the Carriedo waterworks in Manila.

When we consider that, even now, the commoner diseases are mostly of the gastro-intestinal type, i.e. water-borne, and that at certain periods in the past they claimed their victims by the thousands, this contribution to public health must be rated as of the first quality for it ensured the health of the local population. Indeed, Monsiñor O'Doherty, formerly Bishop of Zamboanga and later Archbishop of Manila, used to tell us that when visiting Dapitan on his diocesan inspections, he was not worried about his health as the town had an excellent water supply.

Thus, briefly reviewed, were the activities of Dr. Rizal in practical horticulture, in economic and medical botany, in local pharmacology, in clinical medicine, in medical entomology, in general conchology, in regional ichthyology, ethnology, anthropology, archeology, and sanitary engineering, mostly accomplished while he was a political exile in Dapitan. He led a peaceful but active life. As he wrote, in English, upon one occasion, "My life is now quiet, peaceful, retired and without glory, but I think it is useful too."

A model of activity, a mirror that reflected all the great virtues of his people, blended in him in harmonious unity, the life of Rizal is indeed a sublime example to follow for the youth of his native land.

*Luce resplandeciente tu rica gallardía,
Bella esperanza de la Patria mía.*

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