

New Records of New Caledonian Nonmarine Mollusks and an Analysis of the Introduced Mollusks

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THE ILLUSTRATED HANDBOOK of New Caledonian nonmarine mollusks issued by Franc (1957) has been supplemented by an annotated check list (Solem, 1961). Additional records are given by Solem (1960), and material collected by Borys Malkin between July and October 1958 is reported on here. A few notes on specimens from other sources are included, particularly on two very puzzling shells omitted from Solem's discussion (1960) to allow more critical examination. The location of cited materials is indicated by the following symbols: ANSP (Academy of Natural Sciences, Philadelphia), BPBM (Bernice P. Bishop Museum, Honolulu), CNHM (Chicago Natural History Museum). In each case the catalog number of the set is indicated to facilitate later efforts to consult the cited specimens.

Many of the Loyalty Island records are new, but the most important data are the addition of six species to the New Caledonian fauna, all of them introduced from other areas. *Elasmias apertum* (Pease), *Lamellaxis micra* (Orbigny), *Opeas oparanum* (Pfeiffer), *Varicella* sp., *Dia-stole conula* (Pease), and *Lacteoluna* sp. were not previously known from New Caledonia.

I. RECORDS OF NONMARINE MOLLUSKS

The following locality records were thought worthy of publishing. With minor alterations, the sequence of species follows Solem (1961). References to previous literature can be located in Solem (1961) and are not repeated here.

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Family HELICINIDAE

- Pleuropoma primeana* (Gassies, 1863)
Tadine, Mare, Loyalty Islands (CNHM 109456)
Pleuropoma mediana (Gassies, 1870)
Tadine, Mare, Loyalty Islands (CNHM 109457)

Family POTERIIDAE

- Gassiesia couderti* (Fischer and Bernardi, 1856)
Kuto, Ile des Pins, New Caledonia (CNHM 109427)

Family PLANORBIDAE

- Physastra nasuta* (Morelet, 1857)
Wabawo, Mare, Loyalty Islands (CNHM 109389)
Ouro, Ile des Pins, New Caledonia, in a rapid stream (CNHM 109445)
Muine, Ile des Pins, New Caledonia, in a small, shaded pond (CNHM 109446)
Vao, Ile des Pins, New Caledonia, on leaf debris in a rapid stream (CNHM 109447)
Gyraulus (*G.*) *rossiteri* (Crosse, 1871)
Vao, Ile des Pins, New Caledonia (CNHM 109416)

Family TORNATELLINIDAE

- Elasmias mariei* (Crosse, 1874)
Tadine, Mare, Loyalty Islands, on vegetation (CNHM 109489)
Elasmias apertum (Pease, 1864)
Tornatellina aperta (Pease), 1864, Proc. Zool. Soc. London, 1864: 673, no locality

Elasmias apertum (Pease), Cooke and Kondo, 1960, Bull. B. P. Bishop Mus. 221:222–224, fig. 97 a–d

Tadine, Mare, Loyalty Islands, on vegetation (CNHM 109490)

La Roche, Mare, Loyalty Islands, on vegetation (CNHM 109385)

Cengeite, Mare, Loyalty Islands, on vegetation (CNHM 109386)

The numerous examples obtained show that this is a well-established species on Mare.

Tornatellinops noumeensis (Crosse, 1870)

Tadine, Mare, Loyalty Islands, on vegetation (CNHM 109491)

Family PUPILLIDAE

Gastrocopta (*G.*) *servilis* (Gould, 1843)

Tadine, Mare, Loyalty Islands (CNHM 109352, CNHM 109488)

Family ENIDAE

Subfamily PACHNODINAE

Rhachistia bistrio (Pfeiffer, 1855)

La Roche, Mare, Loyalty Islands, on foliage (CNHM 109435)

Tadine, Mare, Loyalty Islands, on foliage (CNHM 109492)

Cengeite, Mare, Loyalty Islands, under logs (CNHM 109437)

Verdcourt (1961) has confirmed my earlier suggestion (Solem, 1959:60–62) that the New Caledonian–New Hebridean populations are conspecific with the East African *R. braunsii*. Undoubtedly, the Pacific Ocean populations represent a very early accidental introduction by European commerce.

Subfamily DRAPARNAUDIINAE

Draparnaudia lifuana Pilsbry, 1901

Tadine, Mare, Loyalty Islands, on dead foliage (CNHM 109411)

Solem (1962: 219–223, figs. 1–7) studied the anatomy of this material to determine the systematic position of *Draparnaudia*. Previously,

the genus was associated with the sigmurethrous Camaenidae or Bulimulidae and was reluctantly kept in the Camaenidae (Solem, 1961:483–484).

Family SUBULINIDAE

"Opeas" oparanum (Pfeiffer, 1846)

Tadine, Mare, Loyalty Islands (CNHM 109391)

Subulina octona (Bruguère, 1792)

Kuto, Ile des Pins, New Caledonia (CNHM 109429)

Lamellaxis (*Allopeas*) *micra* (Orbigny, 1835)

Helix micra Orbigny, 1835, Magazin de Zool., 1835: 9, Santa Cruz de la Sierra, Bolivia
Kuto, Ile des Pins, New Caledonia (CNHM 109397)

Material reported by Solem (1960) as *O. pumilum* consists of juveniles of this species.

Family OLEACINIDAE

Varicella sp.

River drift at sea coast a few miles from Bourail, New Caledonia (ANSP 281661)

The single worn shell cannot be identified to specific level but is unquestionably a member of this genus (*sensu lato*). This is the first Pacific Ocean record for this Greater Antillean taxon.

Family ENDODONTIDAE

Andrefrancia vincentina (Crosse, 1870)

Foret de Thi Hanna at 800 m elevation, New Caledonia, under bark (CNHM 109353)

Family HELICARIONIDAE

Liardetia (*L.*) *samoensis* (Mousson, 1865)

Dge, Ouen Island, New Caledonia (BPBM 92282)

Tadine, Mare, Loyalty Islands (CNHM 109487)

Muine, Ile des Pins, New Caledonia (CNHM 109375)

Cengeite, Mare, Loyalty Islands (CNHM 109374)

- Diastole (D.) conula* (Pease, 1861)
Helix conula Pease, 1861, Proc. Zool. Soc.
 London, 1861: 243, Tahiti, Society Islands
Diastole (D.) conula (Pease), H. B. Baker,
 1938, Bull. B. P. Bishop Museum, 158:
 46-47, pl. 17, fig. 3, pl. 5, figs. 9, 10
 Tadine, Mare, Loyalty Islands (CNHM
 109380)

A single, slightly subadult specimen provides the first New Caledonian record for this Polynesian species. *D. conula* is widely distributed in the Society and Cook islands and has been reported from Rurutu in the Austral Islands.

- Coneuplecta (Durgellina) calculosa* (Gould, 1852)
 Tadine, Mare, Loyalty Islands (CNHM 109486)
 Vao, Isle des Pins, New Caledonia (CNHM 109366)
 Wabawo, Mare, Loyalty Islands (CNHM 109379)
 Bourail, New Caledonia (BPBM 212153)

Family ZONITIDAE

- Hawaiiia minuscula* (Binney, 1841)
 Kuto, Ile des Pins, New Caledonia (CNHM 109378)

Family EULOTIDAE

- Bradybaena similaris* (Ferussac, 1821)
 Cengeite, Mare, Loyalty Islands (CNHM 109438)
 Tadine, Mare, Loyalty Islands (CNHM 109440,
 CNHM 109443)
 La Roche, Mare, Loyalty Islands (CNHM 109442)
 Kuto, Ile de Pins, Loyalty Islands (CNHM 109441)

Family PARYPHANTIDAE

- Rhytida (Ptychorhytida) inaequalis* (Pfeiffer, 1854)
 Kuto, Ile des Pins, New Caledonia, under logs in forest (CNHM 109413)

- Rhytida (Ptychorhytida) inaequalis* (Pfeiffer, 1846)

Foret de Thi Hanna at 800 m elevation, New Caledonia (CNHM 109387)

Family SAGDIDAE

- Lacteoluna* sp.

River drift at sea coast a few miles from Bourail, New Caledonia (ANSP 151005)

Two worn specimens (ANSP 151005) are easily recognizable as thysanophorine. They may be the young of *Lacteoluna selenina* (Gould). As in the case of *Varicella*, this is the first Pacific record of a West Indian group.

II. NONMARINE MOLLUSCA INTRODUCED INTO NEW CALEDONIA

The New Caledonian land snail fauna contains a number of species that are obvious introductions from other parts of the world, several species that were spread through the Pacific by primitive man, and a few disharmonic elements that, although not yet equated with foreign taxa, are probably human imports. Collecting in the islands was very extensive from 1850 to 1880; thereafter only casual collections were made until 1911, when Sarasin and Roux assembled the materials reported on by Dautzenberg (1923) and Grimpe and Hoffmann (1925). In 1928 T. D. A. Cockerell gathered the specimens listed in Solem (1960), and in 1958 Borys Malkin collected the specimens reported on above. Each collection revealed new additions to the introduced fauna, but the widely separated periods of collecting make information as to the time of arrival impossible to establish for the majority of the imports. Some records exist for introduction of ornamental and food plants (Guillaumin, 1942), but no notice was taken of snails that might have been hidden in the soil-matted roots or sealed to the underside of a leaf. In nearly every case, all we can say is that a particular snail was established prior to a certain date. Despite the limited evidence as to time of introduction, the areas of origin of the introductions form a coherent pattern worth recording.

The following list contains species suspected of being imported, as well as those that were unquestionably brought in by commerce.

Family ANCYLIDAE

Ancylus reticulatus Gassies, 1865, has not been found by subsequent collectors. The original description and figures fail to provide any characteristics by which this species can be separated from the European *A. fluviatilis*. I have not seen material of this species.

Ancylus noumeensis Crosse, 1871, is equally little known. The inclination of the apex to the right precludes the possibility of this being the European *Acroloxus lacustris*, but does not differ from some of the West Indian ancylids. The type locality "Noumea" is in itself suspect, since the city environs were substantially altered even at this early date.

Family VERONICELLIDAE

Laevicaulus alte (Ferussac, 1823) is a Central African species that has been widely dispersed by man into India, Indonesia, and Madagascar (see Forcart, 1953:63-68, 97-98). Much of its African distribution is caused by human agency, so that its original range is unknown. It was not reported from New Caledonia by early workers and was first collected by Sarasin and Roux in 1911.

Angustipes (Sarasinula) plebeius (Fischer, 1868) was described from material collected in New Caledonia about 1863 (see Gassies, 1871:12). Common in New Caledonia, it has been reported in Tahiti, Upolu, and several of the Fijian Islands. Its native range is apparently Brazil and the West Indies, where it was long known as *Angustipes dubius* (Semper) (see H. B. Baker, 1931:134-136).

Family TORNATELLINIDAE

The classification of this family has been put on a magnificent footing by Cooke and Kondo (1960), who also have covered the speciation patterns of the Polynesian, Micronesian, and Hawaiian species in exhaustive detail. Lack of material, however, prevented their giving full

consideration to the affinities of extralimital species. Procurement of adequate samples will undoubtedly prove that many of the peripheral "species" are based on introduced populations of Polynesian species.

Elasmias mariei (Crosse, 1874) is one of the 21 "species" listed by Cooke and Kondo (1960). Unquestionably endemic species are found on Rapa, Rurutu, Raivavae, Guam, and possibly the Caroline Islands. Possibly the remaining species are based upon introduced populations, although their status cannot be satisfactorily evaluated at this time.

Elasmias apertum (Pease, 1864) is widely dispersed in Polynesia. Many localities are known for the Marquesas, Tuamotu, Australs, Society Islands, and Cook Islands, with additional records from Tongatabu, Rotuma, and Sunday Island in the Kermadec Group (see Cooke and Kondo, 1960:223). The New Caledonian introduction, at some time prior to 1958, was probably achieved through commerce with French Polynesia.

Tornatellinops noumeensis (Crosse, 1870) belongs to a very widely distributed genus of 23 "species," at least one of which, *T. variabilis* (Odhner), has been widely dispersed by man. The status of the New Caledonian morph is uncertain, but accidental introduction from Polynesia is a distinct possibility.

Family PUPILLIDAE

Gastrocopta (Sinabbinula) pediculus (Shuttleworth, 1852) is almost universally distributed on both high and low islands of the Pacific Ocean. Pilsbry (1916-1918:141) considered that it might have been native to Indonesia or Melanesia, being carried from there subsequently both by primitive man and modern commerce. It was well established in New Caledonia prior to 1859, when it was described as *Pupa artensis* Montrouzier. Probably it was brought in from Polynesia.

Gastrocopta (G.) servilis (Gould, 1843) is widely spread in the West Indies, Central America, and Brazil (var. *oblonga*) (see Pilsbry, 1916-1918:70-72, 141-144). It was introduced into Hawaii before 1892 and into the Philippines before 1893. The first New Caledonian

collection was made in 1928 (see Solem, 1960).

Pupisoma (Prychopatula) dioscoricola (C. B. Adams, 1845) ranges from South Carolina to southern Florida, and then from southern Texas to Brazil. The equivalent Old World species, *P. orcula* (Benson, 1850), is known from Africa, India, Indonesia, the Philippines, Australia, and some Pacific islands. Quite possibly *orcula* and *dioscoricola* are synonymous. This species was introduced to New Caledonia before 1874.

Family ENIDAE

Rhachistia histrio (Pfeiffer, 1855) is an East African snail introduced into New Caledonia before 1855 (see above).

Family FERUSSACIIDAE

Ceciloides (Geostilbia) aperta (Swainson, 1840) is a strictly West Indian species, although it was found in the gardens of Noumea before 1867.

Family SUBULINIDAE

Subulina octona (Bruguère, 1792) is a tropical American species that long has been dispersed throughout the tropic and warm temperate regions of the world. The first New Caledonian record (Layard, 1889), however, was on plants imported from Reunion Island off Madagascar.

Lamellaxis (Allopeas) gracile (Hutton, 1834) was probably originally from the Neotropical region, but for almost a century has been pantropical in distribution. It was first reported from New Caledonia in 1859.

Lamellaxis (Leptopeas) micra (Orbigny, 1835) is a native of Central and South America and the West Indies. It was first collected in New Caledonia in 1928.

Pseudopeas tuckeri (Pfeiffer, 1846) is an Australian species reported from New Caledonia by Pilsbry in 1906. It has not been dissected and its position in the family is uncertain.

"*Opeas*" *oparanum* (Pfeiffer, 1846) is a puzzling form of uncertain affinity widely distributed in the Pacific islands. It has not been dissected and we have no knowledge of its place in the family. Possibly it is a mutant of a West

Indian or South American species. It was not reported from New Caledonia prior to 1958.

Family HELICARIONIDAE

Coneuplecta (Durgellina) calculosa (Gould, 1852) is widely distributed in the Society, Cook, and Marquesas islands and evidently has been introduced into the Bismarck Archipelago (see H. B. Baker, 1941:234-235). The New Caledonian introduction was prior to 1868.

Liardetia (L.) samoensis (Mousson, 1865) was recorded from Samoa, Fiji, the Cook, Society, Ellice, Marquesas islands, and New Hebrides prior to 1870. In New Caledonia the earliest collection was prior to 1866. A strongly differentiated group of *Liardetia* (subgenera *Dasyconus*, *Oceamesia*, and *Nesoreus*) is endemic in the Society Islands, while the majority of the species will probably be found to be southeast Asian and Indonesian when the helicarionid faunas of these areas are adequately studied.

Diastole (D.) conula (Pease, 1861) is found on several of the Society and Cook islands, and also on Rurutu in the Austral Islands. The New Caledonian introduction, undoubtedly from French Polynesia, was prior to 1958.

Family ZONITIDAE

Hawaiiia minuscula (Binney, 1841) has been recorded from Hawaii before 1850, and from Pitcairn and Tahiti in the 1930's. It was found on Lord Howe Island in 1887, was collected on Norfolk Island before 1913, and has been reported several times from European greenhouses. The first New Caledonian record was in 1888.

Family LIMACIDAE

Deroceras laeve (Müller, 1774) is a Holarctic species introduced into many different parts of the world. It was widespread in New Caledonia by 1911 and probably was introduced before 1871.

Family OLEACINIDAE

Varicella sp. is a member of a West Indian group. The not yet identified species was introduced before 1928.

Family SAGDIDAE

Lacteoluna sp. belongs to a West Indian complex. It was introduced prior to 1928.

Family EULOTIDAE

Bradybaena similis (Ferussac, 1821) was probably native to southeast Asia and Indonesia, but is now pantropical and often present in subtropical areas. It reached New Caledonia before 1911 and has long been established in such Pacific island groups as the New Hebrides, Fiji, Society, and Hawaiian islands.

Family HELICIDAE

Helix (Cryptomphalus) aspersa (Müller, 1774) is a European species widely used for food that has been introduced into nearly all portions of the Pacific world, from California and Juan Fernandez to Tahiti and New Zealand. Its importation to New Caledonia can be traced to a visit by a French man-of-war to Lifu in 1879, with a local Frenchman thoughtfully putting the young in his garden to keep a supply of *escargot* (see Kew, 1893:205-206).

DISCUSSION

It is quite possible that many of the species listed as established comparatively recently were overlooked by earlier collectors, and undoubtedly some of the pantropical species were introduced into New Caledonia from secondary centers (i.e., the West Indian *Subulina octona* being brought in from Reunion Island). Multiple introductions almost certainly happened. Despite these limitations, a chronological listing of introductions shows a reasonable correlation with the patterns of settlement and commerce, and provides an instructive example of the faunal homogenization occurring in land-snail faunas today.

Data on the history have been taken from O'Reilly (1953).

In the early 1840's sandalwood traders were visiting New Caledonia and by 1850 several attempts had been made at establishing missions. During the 1850's considerable coloniza-

tion took place and in 1860 there were 432 European residents. The following introduced snails had been found:

- Rhachistia hystrio* from Africa
- Lamellaxis (Allopeas) gracile* from West Indies or Africa
- Gastrocopta pediculus* from Polynesia (?)

In this period Madagascar and the islands of Mauritius and Reunion were provisioning stops for ships from France to the Pacific. It is thus quite possible that the *Rhachistia* and *Lamellaxis* (presumably well established by this time in the Malagasy region) were brought in on ornamental plants. Possibly the *Gastrocopta* had been introduced by primitive man.

During the 1860's regular service was instituted between French Polynesia and New Caledonia, and ship passage to Europe was reduced to 94 days. Commercial contacts with Australia were moderately frequent. Some ships came via the French West Indies. The following introductions were discovered:

- Ancylus reticulatus* possibly from Europe
- Angustipes plebeius* from the West Indies
- Ceciliodes aperta* from the West Indies
- Coneuplecta calculosa* from Polynesia
- Liardetia samoensis* from Polynesia
- Tornatellinops noumeensis* possibly from Polynesia

All the above can readily be derived through accidental introduction on land plants or on water cress (*Ancylus*).

In the 1870's several colonization schemes suffered varying degrees of success, regular mail service was established with Sydney, and the growing of sugar cane became extensive. Newly discovered imports were:

- Deroceras laeve* probably direct from Europe
- Helix aspersa* from a French man-of-war
- Elasmias mariei* possibly from Polynesia
- Pupisoma dioscoricola* from the West Indies
- Ancylus noumeensis* from an unknown locality

The growth in importance of the nickel mines, increasing colonization, and better com-

munications between 1880 and 1911 produced the following set of introductions:

- Laevicaulus alte* from Africa
- Subulina octona* from Reunion (originally West Indies)
- Pseudopeas tuckeri* from Australia
- Hawaiiia minuscula* originally North American, but direct source unknown
- Bradybaena similis* most probably on sugar cane, source unknown

With most of the molluscan "tropical tramps" well established by 1911, the rate of additions decreased, probably reflecting growing stringency of quarantine regulations as well as a decrease in the number of candidates for introduction. New records are all of West Indian taxa:

- Gastrocopta servilis* from West Indies
- Lamellaxis micra* from West Indies
- Varicella* sp. from West Indies
- Lacteoluna* sp. from West Indies

The effects of the depression of the 1930's and isolation from normal commerce caused by World War II may have been the reasons behind restricted introductions from 1928 to 1958. Only three more species were added:

- Elasmias apertum* from Polynesia
- "*Opeas*" *oparanum* from Polynesia
- Diastole conula* from Polynesia

As would be expected, the centers of commercial contact, particularly in regard to interchange of plant products, have provided by far the largest portion of the introduced taxa. French Polynesia, the West Indies, and the former French possessions of the Malagasy region each contributed heavily, with a much smaller number coming from Europe and, possibly, only one from Australia. *Hawaiiia minuscula* and *Bradybaena similis* had attained such a wide dispersal prior to their discovery in New Caledonia that no guess can be hazarded as to the source of the New Caledonian populations.

So far, New Caledonia has not received the Giant African Snail, *Achatina fulica*, that is such a nuisance in many parts of the Pacific. It does, however, have its full share of the land snail "tropical tramps," those species found, for

example, in the port towns of the southeastern United States, Central American coastal cities, Mauritius, Singapore, and nearly every Pacific island regularly served by commerce. Hawaii, Tahiti, Viti Levu, Guam, and countless other islands have their cultivated and otherwise ecologically altered areas taken over by this pantropical snail fauna. The famed endemic land snails of the Pacific islands are restricted to the rapidly shrinking patches of native forest. In all too short a time the land snail fauna of the Pacific islands will consist solely of a homogeneous blend of the introduced forms listed above. It is with a real sense of sadness that I have attempted to chronicle for the terrestrial malacologist of 2020 the places where the living land snails of Polynesia and Micronesia originated!

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