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EPIZOIC SYMBIOSIS: CRYPTOGAMIC PLANTS GROWING ON VARIOUS WEEVILS AND ON A COLYDIID BEETLE IN NEW GUINEA[1]

By J. Linsley Gressitt

Bishop Museum, Honolulu

Abstract: In addition to the weevil genus *Gymnopholus* discussed in a preceding paper in this issue, fungi, algae, lichens and liverworts grow on the bodies of members of several genera of Papuan Cryptorrhynchinae. Also, algae, fungi and lichens grow on certain Otiorrhynchinae, algae and fungi on Baridinae, and lichens on Colydiidae. Certain mites may be associated with some of these plants on the beetles.

This is the fourth of a series of papers in this issue[2] dealing with symbiotic relationships between cryptogamic plants and certain Coleoptera. Acarina are involved in some of these relationships, and also other invertebrate animals. The records in this paper largely relate to mountain areas on the main island of New Guinea, but one in part involves a lowland area in New Britain. Some of the weevils are from high altitudes as with the *Gymnopholus* weevils, but others are from lowland rain forest. The colydiid is from medium altitudes.

Among the beetle-plant associations reported here it appears that mutualistic symbiosis is involved in most or all cases, although there is less conclusive evidence that special modifications have been evolved on the part of the beetles to encourage or protect the plants. Most of the weevils involved have strong tubercles or ridges which offer considerable protection to the plants. However, these structures are also found in numbers of species in Australia, as well as in New Guinea, which do not appear to have any such plant relationships. This raises the question of the factors involved in influencing the course of evolution of the structural modifications. Many weevils have tubercles, nodes, ridges and other conspicuous structures of no clear function. Some of these structures, of course, may in themselves serve the function of camouflage, causing the weevils to resemble inanimate objects, or to look like parts of plants, or at least rather little like living insects. Combined with these structures is the habit of many of these weevils to drop to the ground when disturbed, shamming death and placing their legs in peculiar positions, often folded beside or beneath the body. To be sure the growth of plants on these weevils may serve to help camouflage them or to cause them to resemble plant parts, or pebbles, in a more effective manner.

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2. See also Gressitt, Sedlacek & Szent-Ivany, 1965, *Science* **150**: 1833–35.

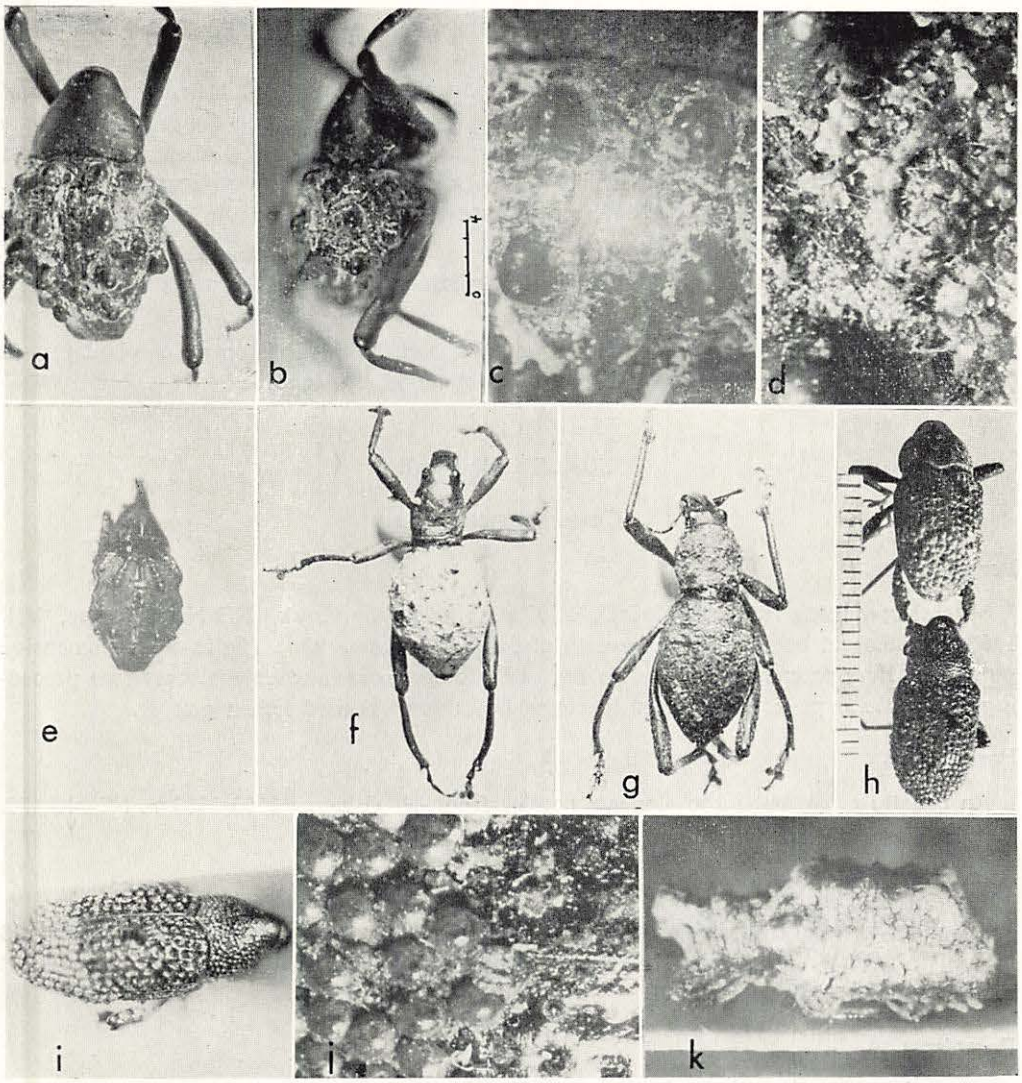

Fig. 1. Weevils and a colydiid bearing plant growth: a, *Poropterus* sp., bearing liverworts of the Metzgeriaceae and Lejeuniaceae, Mt Kaindi, NE New Guinea; b, ditto, side view; c, ditto, scutellar portion of elytra, ×9; d, ditto, ×18; e, cryptorrhynchine weevil from Mt Kaindi with fungal-algal growth with high ratio of algal growth; f, *Pantorhytes* sp. from Ilafo, with lichenized fungal growth; g, *Pantorhytes* sp. from Mt Yelia with dense fungal-algal growth and patch of lichen on hind portion of left elytron; h, *Aclees porosus* Pasc. from Gazelle Peninsula, New Britain, with dense aggregation of uropodine mites on dense fungal growth on elytra and hind femora; i, ditto, side view of lower specimen; j, ditto, anterior edge of congregation on elytra, ×10; k, colydiid, *Dryptops phytophorus* Sam., with lichen growth, Wau, NE NG, ×8.

It appears as if a secretion may be produced by the weevils to encourage the plant growth on their backs, as in *Gymnopholus*. This fortifies the assumption that the plant growth is beneficial to the beetles.

No evidence has as yet been found of the occurrence of oribatid mites in the fungi and lichens on the beetles treated in this note. However, some other mites are present on some of the beetles, and in part they appear to be involved in a relationship of some sort. Most of these mites are uropodines, which are generally considered to be phoretic on beetles. However, in the case of the baridine weevil *Aclees*, the large uropodines appear in some cases to be congregated on dense fungal growth.

Rotifers are present on some of the cryptorrhynchine weevils supporting dense funga and algal growth.

In the following listing, various types of weevils, and the colydiid, on which plant growth has been found, are briefly mentioned, with the plant groups involved.

CURCULIONIDAE

CRYPTORRHYNCHINAE

Poropterus sp.

Several specimens from Mt Kaindi, 2300 m, above Edie Creek, NE New Guinea, VII. 1965, J. Sedlacek, bear moderate growth of fungi and algae. One (fig 1a–d) has extensive growth of liverworts representing the families Metzgeriaceae and Lejeuniaceae (see preceding *Gymnopholus* paper). Another specimen bears some limited lichen growth.

Poropterus sp.

An equally large, but more elongate species from Mt Giluwe, 2500–2750 m, SE NG, 30. V. 1963, has moderate growth of fungi and algae.

Poropterus sp.

A similar species with stouter elytral tubercles from the Owen Stanley Mts (Bome, 1950 m, 7. III. 1958, W. W. Brandt) has fungal and algal growth and some large subrounded uropodine mites.

Poropterus sp.

A relatively slender species from Wau, 1700 m, NE NG, 28.I.1963, Sedlacek, bears fungi, algae and lichen growth. It also bears some rather flat, fairly elongate mites, which may not be uropodines.

Pseudoporopterus sp. (not *karnyi*)

An elongate, suboblong species with very prominent tubercles, from Eliptamin Valley, 1200–1350 m, 16.VIII.1959, Brandt, bears fungal and algal growth.

?Poropteropsis sp.

A species from Mt Kaindi, 2300 m, NE NG, 8.VI.1962, Sedlacek, bears algal growth and

numerous small mites, possibly uropodines.

?Poropteropsis sp.

A species from Mt Giluwe bears fungal and algal growth.

Some other unidentified cryptorrynchine genera bear extensive fungal and algal growth. One from Mt Kaindi, 2300 m, VI.1962, has a high ratio of algal growth (fig 1e).

OTIORRHYNCHINAE

Pantorhytes sp. Fig. 1f.

A fairly broad species from Ilafo, 2200 m, between Kainantu and Okapa, 7. I. 1965, J. J. H. Szent-Ivany, has upper surfaces of elytra densely covered with a dense white mat, leaving only tops of tubercles exposed. This appears to consist of lichenized fungal growth. Rotifers are present.

Pantorhytes sp. Fig. 1g.

A more slender species from Mt Yelia, Morobe Distr., NE NG (edge of rim of crater, 3300 m, 20. I. 1963, G. Rosenberg), is somewhat heavily matted with fungal-algal growth, and has a patch of lichen growth on left elytron.

?Elytrocheilus sp.

A large species from Wau Creek, Wau, NE NG, 1200 m, IX. 1964, Sedlacek has limited fungal and algal growth.

BARIDINAE

Aclees porosus Pascoe Fig. 1h–j.

Two specimens from Gaulim, 130 m, and Upper Warongoi Valley, 200 m, Gazelle Peninsula, New Britain, X.1962, Sedlacek, have a dense population of large, subrounded ochraceous uropodine mites. The mites are congregated on approximately posterior 2/5 of elytra, on fairly thick orange fungal growth. The mites are somewhat symmetrically arranged, in line with the puncture-rows. They are of about the same size as the punctures.

COLYDIIDAE

Dryptops phytophorus Samuelson Fig. 1k.

This species, described in the preceding paper, has some individuals completely covered above with lichenized fungal growth. The growth, when fresh, is pure white with some clouding of green. The dense covering of fine hairs appears as if it were evolved to encourage the plant growth, as with some species of *Gymnopholus*. Some of the specimens from lower altitudes apparently lack the plant growth, though they might represent freshly emerged individuals. Those bearing lichen growth were taken under very wet kunai grass by the splashing Wau Stream, at 1200 m, Wau, NE New Guinea, by Sedlacek.