Geographical distribution of the Mallophaga (Insecta)

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The distribution of the Mallophaga is essentially a host distribution, but as the group becomes better known, instances are being found of what appear to be geographical distribution of species. The following discussion applies only to relationships between Mallophaga parasitic on birds belonging to the same host order. A species of Mallophaga parasitic on

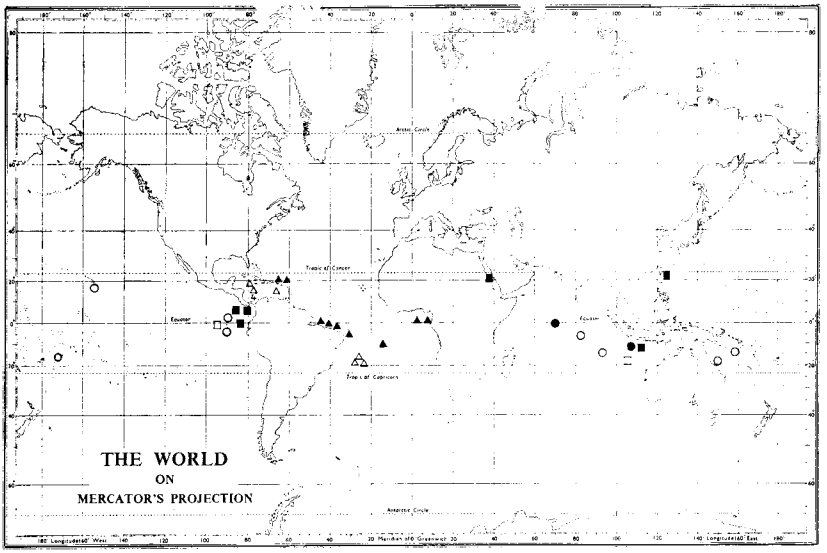

Figure I

KEY

Triangles = *Pectinopygus garbei*
▲ = *Sula leucogaster*
△ = *Sula sula*

Circles = *Pectinopygus sulae*
● = *Sula leucogaster*
○ = *Sula sula*

Squares = *Pectinopygus annulatus*
■ = *Sula leucogaster*
□ = *Sula sula*

one species of bird may be the same or similar to that on a not closely related bird living in the same geographical area instead of, as is usual, being nearer to those species parasitic on the most nearly related hosts wherever these occur. A possible example of this (see Clay, 1961 : 53) is the presence of a species of *Rhynonirmus* on *Bartramia longicauda* (subfamily Tringinae), *Rhynonirmus* being a mallophagan genus elsewhere restricted to the subfamily Scolopacinae. The species of *Rhynonirmus* found on *Bartramia* is similar to that on *Philohela* (Scolopacinae)—the breeding ranges of the two birds overlap. Such distributions may be explained by one of the following hypotheses:

1. The species parasitic on *Bartramia* was secondarily acquired from *Philohela*, became established on the new host and subsequently diverged through isolation and adaption to the environment of its new host.

2. The genus *Rhynonirmus* was originally found throughout the Charadriidae and has become extinct on all species except *Bartramia* and those belonging to the Scolopacinae.
3. The phylogenetic position of *Bartramia* is with the Scolopacinae not with the Tringinae (see Timmermann, 1957: 87).
4. In some cases, although not that of *Bartramia*, the louse which appears to have an anomalous distribution may be on the wrong host due to contamination during collecting or temporary natural straggling. It has been shown (Clay, 1962: 200) how it is sometimes possible to check whether specimens taken from a certain host belong to an established population on that host or are temporary stragglers.

The distribution of two of the species of wing lice (*Pectinopygus*) on the gannets (Sulidae) appears to be geographical and is of different kind to that of the *Bartramia* parasites and rather more difficult to explain.

The members of the Sulidae are parasitised by a number of species of *Pectinopygus* of which one distinctive species (*P. bassani* [Fabricius]) is restricted to *Morus;* a second species (*P. annulatus* [Piaget]) is found on *Sula nebouxi*, *Sula dactylatra*, *Sula leucogaster* and possibly *Sula sula*, with perhaps related forms on *Sula variegata* and *S. abbotti*. The distribution of these species follows a normal pattern; a species group (*P. annulatus*) parasitising a number of related birds and a distinct but related species (*P. bassani*) on a distinct but related group of hosts (*Morus*.) In addition, on *Sula sula* and *Sula leucogaster* there are two rather similar species, *Pectinopygus sulae* (Rudow) and *P. garbei* (Pessôa & Guimarães), which on the available material, show an unusual type of distribution. Figure 1 shows that Mallophaga collected from *Sula sula* and *Sula leucogaster* in the Atlantic area belong to *P. garbei* and those from *Sula sula* in the rest of its range and from *S. leucogaster* in the Indian Ocean belong to *P. sulae*. This is an unusual distribution pattern for species of Mallophaga and its explanation is difficult. The following possibilities are suggested:

1. These results are based on insufficient material and, in fact, both species occur on both hosts. In spite of the 28 records available this is possible and one of the reasons for publishing this note is to appeal for more material from all the species of *Sula*.
2. Originally both species occurred on both hosts and for some reason *P. sulae* died out in one area and *P. garbei* in the other. However, these two species do not show the character differences usually associated with sympatry and appear more likely to be host replacements of each other. It is also difficult to suggest what ecological or other factors might have led to the elimination of the one species in each of the areas concerned.
3. Originally *P. sulae* was restricted to one host and *P. garbei* to the other, and in one area *P. sulae* became extinct on one host which secondarily acquired *P. garbei* and the reverse process took place in the other. Again a rather complicated and unlikely explanation.
4. One of the hosts, say *Sula sula*, was parasitised by a louse population of the *sulae-garbei* type. The population of this bird living between the continent of America and Africa became isolated from the rest of the population by these land barriers, thus isolating their louse

populations. As a result these diverged and ultimately became two well defined forms (see Clay, 1949: 283–284). If these were acquired secondarily by *Sula leucogaster*, then this host would have acquired one form of the louse (*P. garbei*) from *Sula sula* in the Atlantic area and the other (*P. sulae*) in other parts of its range. This is more likely to have happened before *Sula sula* took to the un-gannet-like habit of nesting in trees and bushes which would have made contact between the two hosts less probable. It would appear that *Sula leucogaster* is frequently parasitised by *P. annulatus* (see fig. 1) and it is possible that where this species is absent the *sulae* group can become established. It is perhaps significant that in the Atlantic area where *garbei* is commonly found on *S. leucogaster*, there are no records of *annulatus*.

The following statements by Murphy (1936) support the suggestion that Africa and the American continent would have formed effective barriers to the gannet populations: "there can be no question about the fact that the Brown Booby (*S. leucogaster*) finds in this strip [Isthmus of Panama] an effective barrier against natural distribution from either oceanic region to the other (p. 854)" ". . . boobies in general shy off continental coasts and . . . rarely if ever cross extensive bodies of land" (p. 863).

More material of Mallophaga from all species of *Sula* may help to elucidate these problems of distribution.

HOSTS AND LOCALITIES

Host	*Locality*	*No. of hosts*
Pectinopygus garbei (Pessôa & Guimãraes, 1935).		
Sula leucogaster (Boddaert)	Puerto Rico	2
	Coast of Brazil	4
	Ascension Is.	1
	Gulf of Guinea	2
Sula sula (Linn.)	Little Cayman, Jamaica	5
	Puerto Rico	1
	Trinidad Is., S. Atlantic	3
Pectinopygus sulae (Rudow, 1869)		
Sula leucogaster (Boddaert)	Maldive Is., Indian Ocean	1
	Java	1
Sula sula (Linn.)	Cocos Is., Indian Ocean	1
	Indian Ocean	1
	Rennel Is., Coral Sea	1
	South Diamond Islet, Coral Sea	1
	Hawaii	1
	Galapagos	2
	Lat. 15° 9′, long. 175°	1
	Lat. 15° 9′, long. 175° 50 W	1

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