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ISLANDS - ENDEMISM AND THREATENED BRYOPHYTES

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RESUMEN

El número de taxa y el endemismo entre las hepáticas de las islas del Pacífico sudoccidental es comparado con el de África central. También se compara el espectro general de tamaño de los taxa de hepáticas en un archipiélago (Samoa) con el de una área similar de un continente (Uganda). El número de taxa es en general ligeramente más alto en las islas del Pacífico y el porcentaje de taxa endémicos es significativamente más alto en Pacífico sudoccidental que en África central (20% y 2.5%, respectivamente). El área media de distribución es ligera pero significativamente más grande para los taxa continentales. Se discute la amenaza potencial para los taxa con áreas de distribución pequeña junto con las consecuencias para la conservación.

Palabras clave: Oceanía, África, hepáticas, áreas de distribución.

ABSTRACT

The number of taxa and the endemism among the hepatics on islands in the southwest Pacific is compared with central Africa. The general range size of hepatic taxa in an archipelago (Samoa) is also compared with that in a comparable area on a major continent (Uganda). The number of taxa is in general slightly higher on the Pacific islands and the percentage of endemic taxa is significantly higher in southwest Pacific compared with central Africa (20% and 2.5%, respectively). The mean distribution area is slightly but significantly larger for the continental taxa. The possible threat to taxa with small ranges is discussed together with the consequences for conservation.

Key words: Oceania, Africa, hepatics, distribution ranges.

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INTRODUCTION

It is often argued that the efforts and limited resources for conservation that each country has available should primarily be spent on taxa that have their main or only occurrence within that country. A high number of endemic taxa or taxa with narrow ranges means thus that a country may be responsible for the global survival of more taxa than countries with fewer taxa of this kind. This is less of a problem if the local taxa are not threatened. However, small ranges are in themselves a potential threat for many taxa, increasing the need at least for observation of population development. As long as the population stays stable, there is no need for active conservation. But if the populations are very small or only occurring in so small areas that they may be wiped out by a single stochastic event, actions should be taken to prevent such man-made events from taking place.

Endemism is usually considered to be higher on islands than on mainlands. Island countries are therefore expected to have to secure the global survival for more taxa than countries on the mainland. There are, however, no detailed investigations as to whether the average distribution ranges differ between oceanic islands and continents. This investigation aims to see whether a large proportion of hepatic taxa are endemic on islands compared with mainlands and to analyze the sizes of distribution areas. No attempt is made to distinguish between threatened and non-threatened taxa or rarity along other parameters than size of distribution areas.

METHOD

All known taxa for the southwest Pacific, West-Central Africa, East Tropical Africa and South Tropical Africa (as delimited by Hollis and Brummit, 1992, but excluding the Guinea Gulf Islands) are registered and the number of taxa occurring in each of their "Botanical Countries" (level 3) are calculated. These regions are selected since good checklists exist and they are about equally well explored bryologically. For the SW Pacific, Miller et al. (1983) is used with some updating from recent floristic and taxonomic literature, and for central Africa the checklist by Wigginton (unpubl. ms.) is used.

In each of the regions (SW Pacific and C Africa) one botanical country (Samoa and Uganda, respectively) is selected for studies of distribution ranges for the taxa. For all taxa occurring in these countries, the world distribution is registered and the number of botanical countries where the taxa are registered are counted.

RESULTS

Number of taxa

For many botanical countries of the SW Pacific (Nauru, Gilbert Is., Howard-Baker Is., Phoenix Archipelago, Tuvalu, Tokelau Manihiki and Niue) no hepatics are

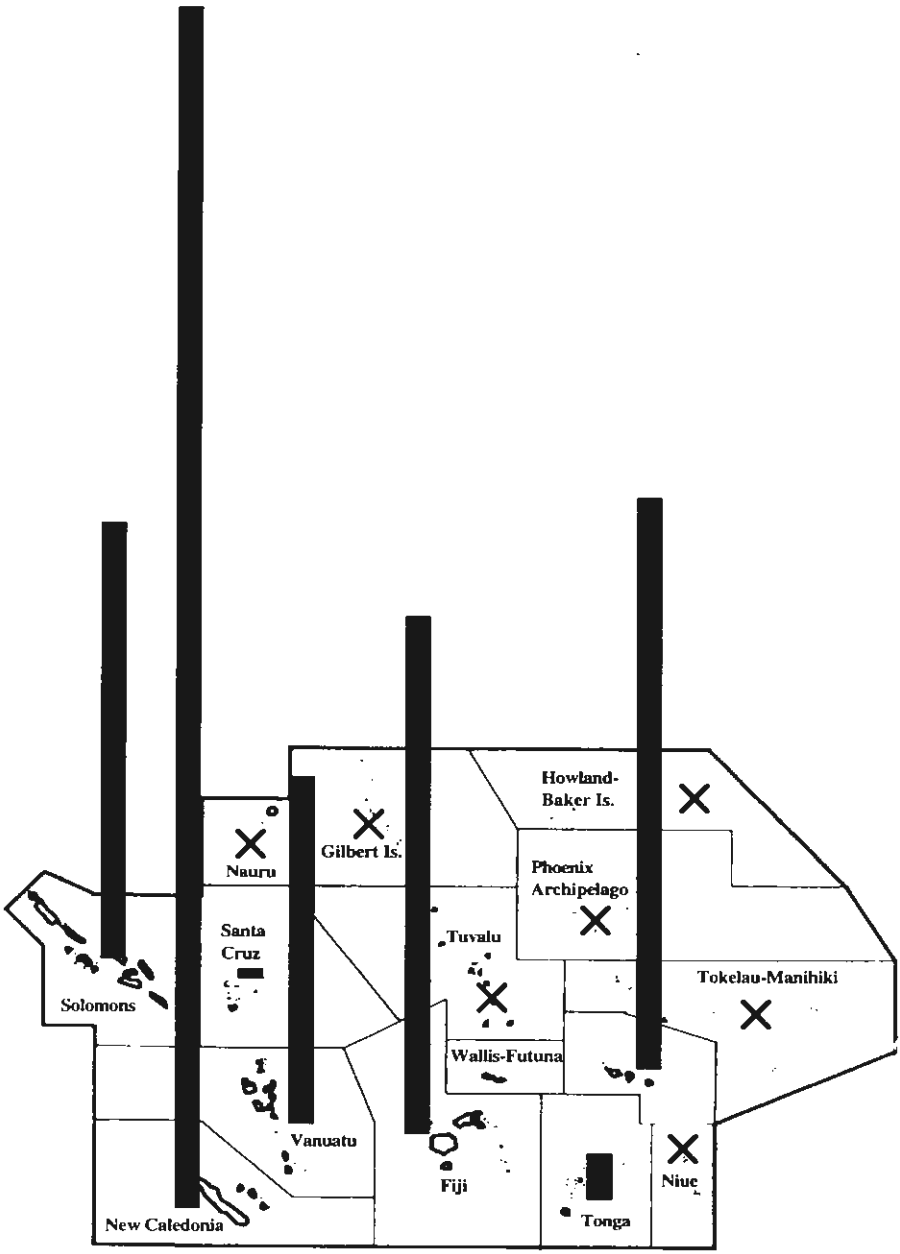

Fig. 1. Number of hepatic taxa recorded in the SW Pacific. X means that no taxon is recorded.

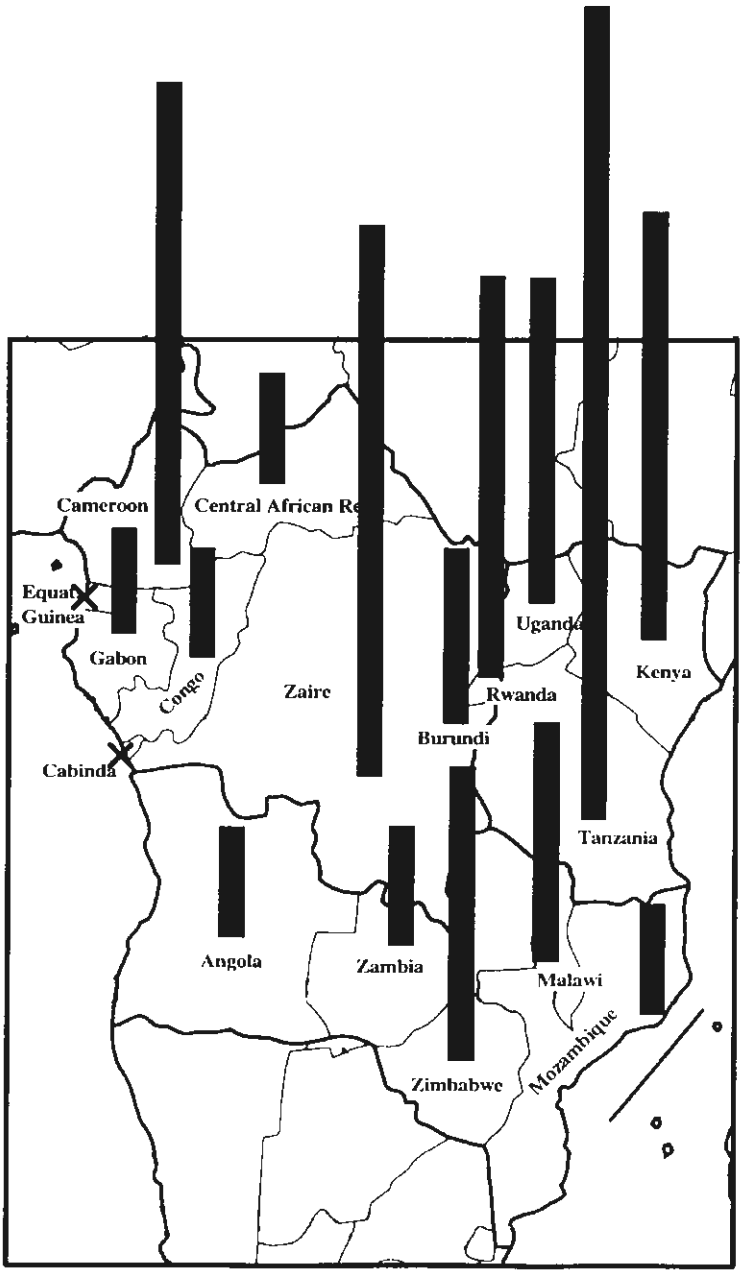

Fig. 2. Number of hepatic taxa recorded in central Africa. X means that no taxon is recorded.

noted (Fig. 1) and only 4 taxa are noted for Santa Cruz and 18 for Tonga. The number of taxa is considerably higher in Solomon Is. (176 taxa), Vanuatu (137), New Caledonia (485), Fiji (208) and Samoa (229).

In only two of the botanical countries in C Africa (equatorial Guinea and Cabinda) are no hepatic taxa noted (Fig. 2). A small number of taxa are noted for Gabon (50 taxa), Congo (52), Central African Republic (53), Angola (55), Zambia (57), Mozambique (53) and Burundi (83), while there are more taxa noted for Cameroon (227), Zaire (258), Rwanda (191), Uganda (154), Kenya (201), Tanzania (393), Zimbabwe (139) and Malawi (113).

Number and proportion of endemic taxa

The number of endemic taxa in the botanical countries of the SW Pacific is 7 in the Solomon Is. (4.0 % of their taxa), 2 in Santa Cruz (50 %), 23 in Vanuatu (24.1 %), 218 in New Caledonia (44.9 %), 20 in Fiji (9.6 %) and 40 in Samoa (17.5 %) (Fig. 3).

In Africa, there are no known endemic hepatics in Congo, Burundi, Angola, Zambia and Malawi, and the number is also low for the other countries, 13 in Cameroon (5.4 %), 1 in Central African Republic (1.9 %), 1 in Gabon (2.0 %), 14 in Zaire (5.4 %), 5 in Rwanda (2.6 %), 9 in Uganda (5.8 %), 6 in Kenya (3.0 %), 31 in Tanzania (7.9 %), 2 in Zimbabwe (1.4 %), and 1 in Mozambique (1.9 %) (Fig. 4).

The mean number of endemic taxa in each botanical country in the SW Pacific and in C Africa (21.3 and 4.8, respectively) differs significantly from each other (Mann-Whitney U-test; $p<0.001$).

Distribution ranges

The 229 taxa on Samoa are found in one to 100 botanical countries with an average of 12.8 and a median of 6 botanical countries (Fig. 5). The 154 taxa in Uganda are found in 1 to 115 botanical countries with an average of 19.0 and a median of 11 botanical countries (Fig. 6). The difference in average number of botanical countries are statistically significant (t-test; $p>0.01$).

DISCUSSION

The number of taxa per botanical country is somewhat higher in C Africa than in the SW Pacific (except for New Caledonia). The lower number of taxa on islands is as postulated by the island biogeography theory (MacArthur and Wilson, 1967) and shown for many organism groups.

The results also clearly confirm that the endemism of hepatics is higher on the islands of the SW Pacific than on continental C Africa. This is true even if one excludes New Caledonia, an island known for its extremely high endemism among plants.

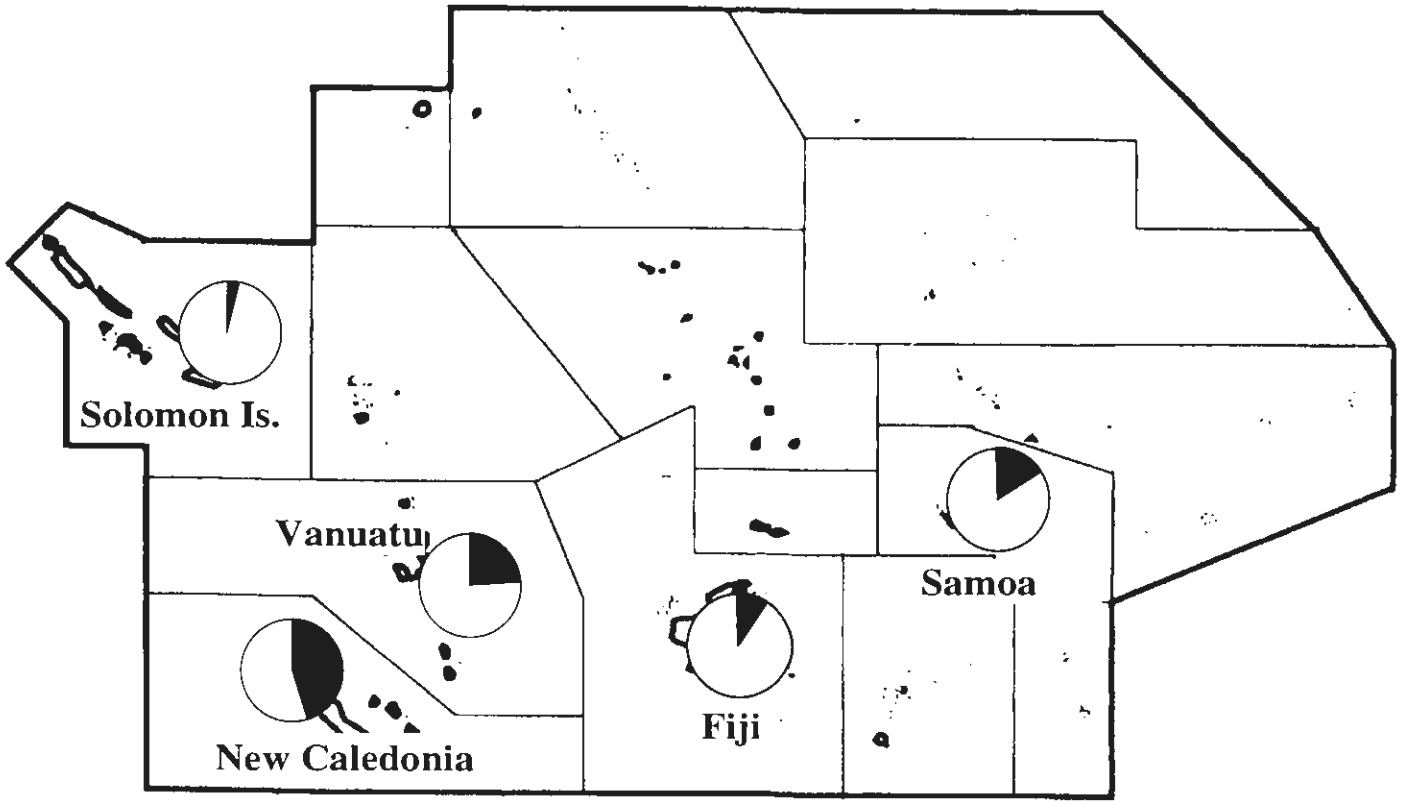

Fig. 3. Proportion of endemic hepatic taxa in the botanical countries of SW Pacific where at least 50 taxa are recorded.

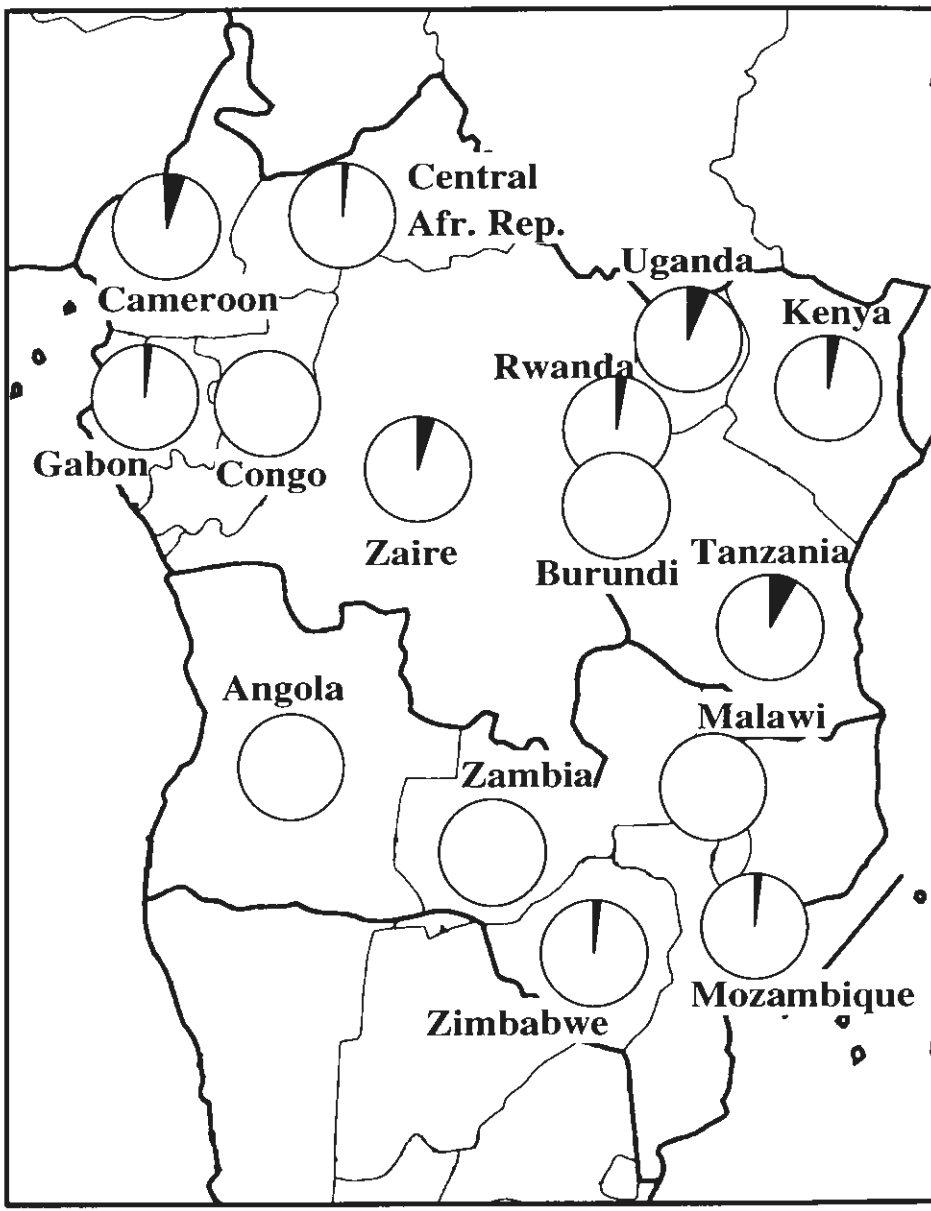

Fig. 4. Proportion of endemic hepatic taxa in the botanical countries of central Africa where at least 50 taxa are recorded.

The isolation of islands is reflected in the taxa composition and two types of taxa found. First, there are taxa that are successful dispersers that can overcome the barriers of the oceans. These taxa tend to have large distribution areas as, *e.g.*, *Metzgeria leptoneura*. Secondly, there are taxa that are poor dispersers. They have probably arrived on the island by chance dispersal or they are a remnant from an earlier period when the island was closer to the mainland. Today, they are isolated and do not have any genetical exchange with populations on other islands. Due to the small populations that generally occur on small isolated islands, they may evolve through, *e.g.*, genetical drift and eventually become endemic taxa. Therefore, islands should have more endemic taxa and more widespread taxa than average but less of intermediate ranges. This investigation shows that the islands have more restricted taxa, but the proportion of widespread taxa seems to be rather similar between the two regions.

Taxa with small distribution ranges can be separated into two groups, those that are naturally rare and those that have decreased in population size. The naturally rare taxa are adapted to small population sizes and may thus only be threatened by the stochastic events that may wipe out a small population. In the taxa with decreasing population sizes, on the other hand, the genetical variation may be reduced, but since genetic drift has acted more or less randomly, and selection has had no time to adapt them to the new conditions, they may be less suited to survival in a changing environment. More effort should therefore be put into monitoring and conservation of decreasing taxa than those with stable population sizes, even if the former still have comparatively large population sizes where they occur.

It is often argued among conservationists that every country should be responsible for conserving the taxa that occur only in that country, or that have their main occurrence there. This means that island countries with more endemic taxa will need to put more effort into taxa monitoring and conservation than continental countries in order to conserve as many taxa as possible. Considering the relatively small size of most of the island countries, this will be an even higher burden. Samoa needs, *e.g.*, to invest about 4 times as much into monitoring and conservation than Uganda, even though they have a smaller population and the PCI is at the same level in both countries. On the other hand, the naturally small populations of the rare island taxa have survived for long periods and they are less vulnerable to extinction than taxa with decreasing populations. The results will probably be that, without large-scale habitat destruction, island countries will have to put more effort into monitoring whereas conservation actions should remain on the same level.

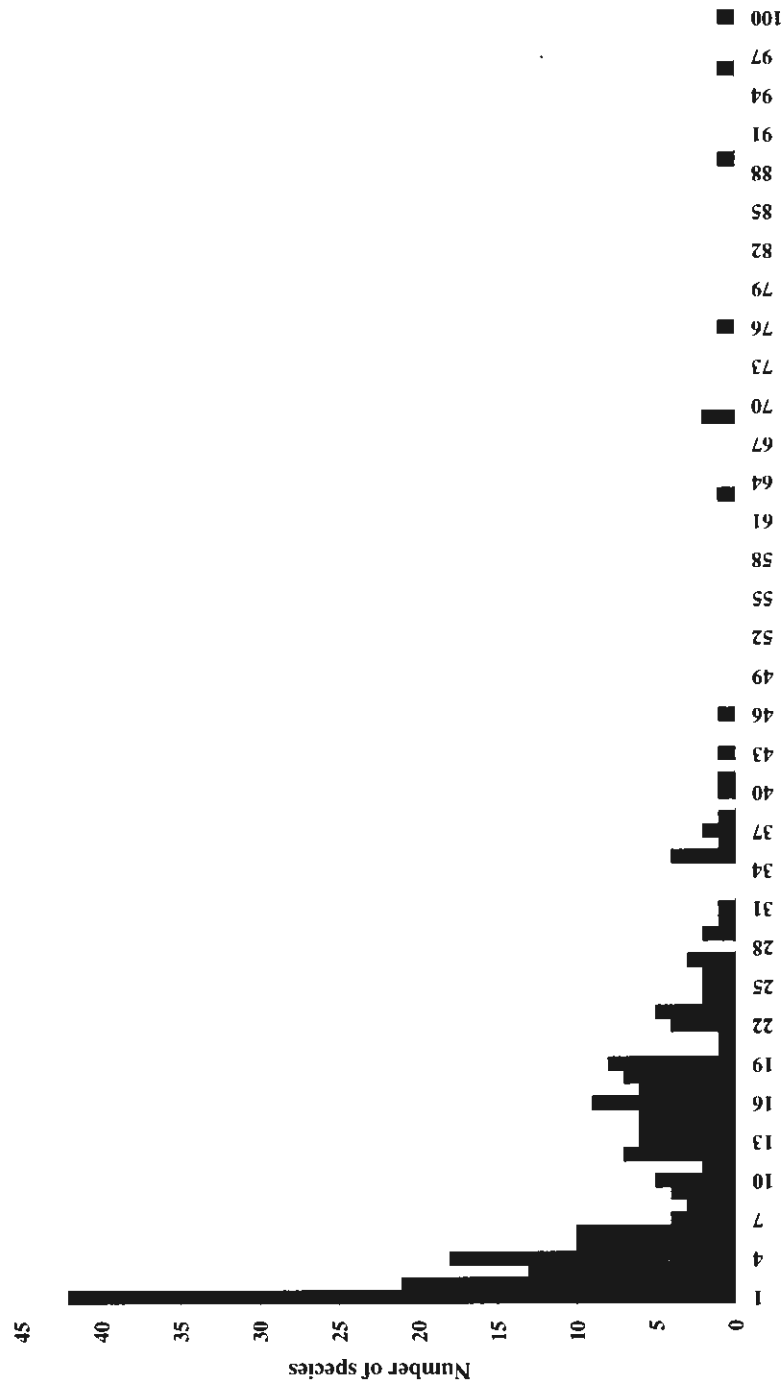

Fig. 5. Number of botanical countries that taxa on Samoa are recorded from.

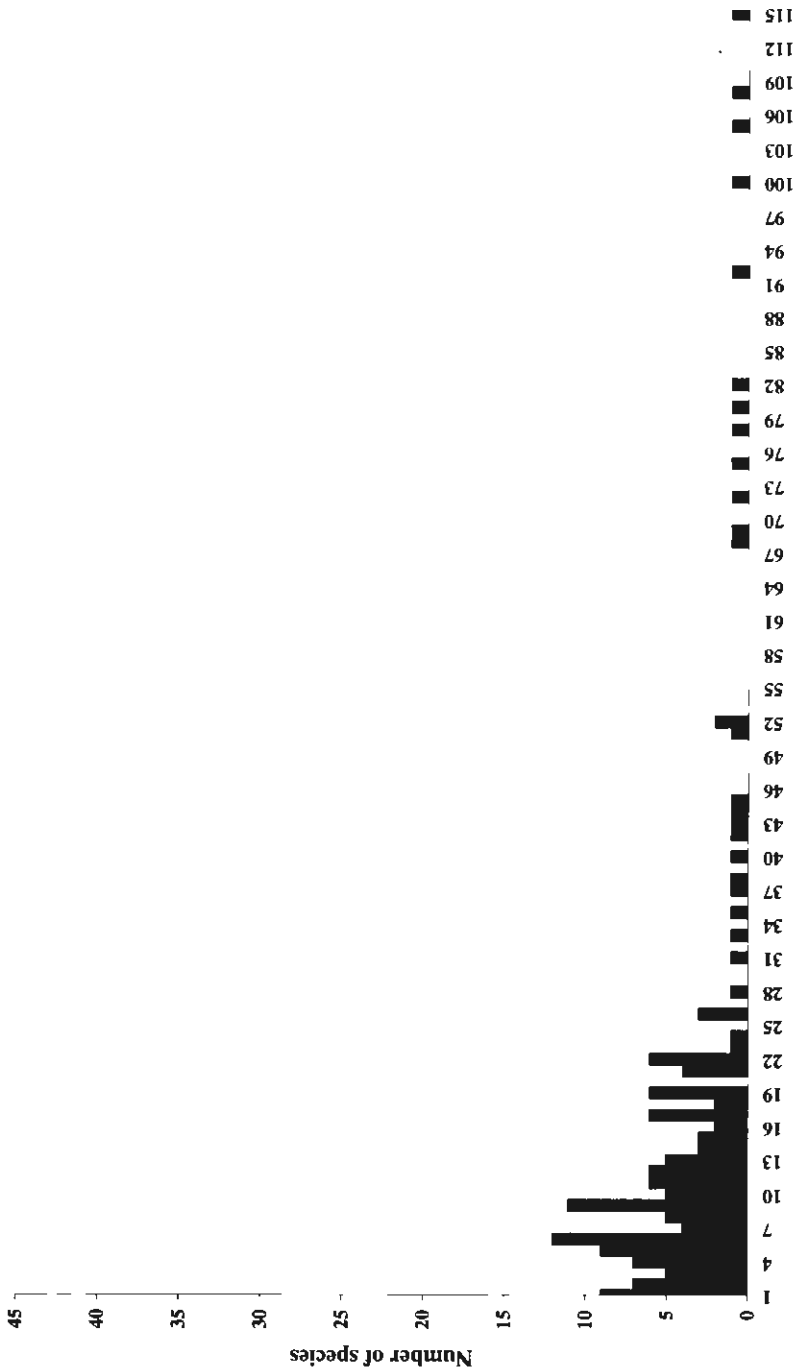

Fig. 6. Number of botanical countries that taxa in Uganda are recorded from.

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