

ESTUDIOS SOBRE DIVERSIDAD Y ECOLOGIA DE PLANTAS
Memorias del II Congreso Ecuatoriano de Botánica
realizado en la
Pontificia Universidad Católica del Ecuador, Quito
16—20 Octubre 1995

editores
Renato Valencia & Henrik Balslev

Publicado por
PONTIFICIA UNIVERSIDAD CATOLICA DEL ECUADOR
en colaboración con
UNIVERSIDAD DE AARHUS, DINAMARCA
(PROYECTO ENRECA) Y
PROGRAMA DANES DE INVESTIGACION DEL MEDIO AMBIENTE
(PROYECTO DIVA)

1997

Werneria s.l. (Compositae: Senecioneae) in Ecuador

V. A. Funk

U.S. National Herbarium, Department of Botany, Smithsonian Institution, MRC 166, Washington, D.C., 20560, USA, tel (+1) 202-357-2560, fax (+1) 202-786-2563, email unhbo003@sivm.si.edu

Abstract

Six of the nine species of *Werneria* s.l. from Ecuador have recently been placed into the new genus *Xenophyllum*. These two genera are frequently collected in the high elevations of Ecuador. A key to species is included, each species is discussed, and illustrations are provided for six of the nine species.

Resumen

Seis de las nueve especies de *Werneria* s.l. del Ecuador han sido agrupadas recientemente en el género *Xenophyllum*. Estos dos géneros se han recolectado frecuentemente en las altas montañas del Ecuador. En este estudio, se incluye una clave de especies, se discute cada una de ellas, y adicionalmente se presentan seis ilustraciones de las nueve especies discutidas.

Introduction

Werneria s.l. is a high elevation genus with 40-50 species. All of the species are confined to the Andes, from Merida in Venezuela to Patagonia, except one which extends northward via a few isolated populations in Mexico and northern Guatemala. The largest concentration of species is found from southern Colombia to northern Argentina and Chile. The genus is closely related to *Senecio* and its relatives, a large, variable and cosmopolitan group. Although members of the genus are rarely misidentified, the variability of *Senecio* makes it difficult to identify characters to separate the two genera. The character that is most frequently used to circumscribe *Werneria* s.l. is the fusion of the involucre bracts at least half way (Fig. 1a) (Blake 1928, Humbolt *et al.* 1820, Rockhausen 1939, Weddell 1856), however, the fusion of the involucre bracts varies a great deal; they sometimes are fused less than half in many of the species of *Werneria* s.l., and more than half the length in some members of *Senecio*. In addition, the fusion is partially a function of the maturity of the head with some involucre bracts that are fused at the base, splitting in late flowering or fruiting stages. Another character that is consistent in *Werneria* s.l. is that there is never a well-developed calyculus (Fig. 1a, note the bracts at the base of the head). Unfortunately while many members of *Senecio* and related genera have a calyculus (Fig. 1b), there are quite a number of members that lack this structure. Finally, all but three of the species have white ray florets (two have yellow and one has purple), however all

three colors are known in *Senecio*. If a plant has white rays, a fused involucre, and no calyculus then it is a member of this group but realistically that would only account for approximately 70% of the species attributed to *Werneria s.l.* In my opinion the genus is not monophyletic, in fact, there are at least three and possibly four separate monophyletic groups.

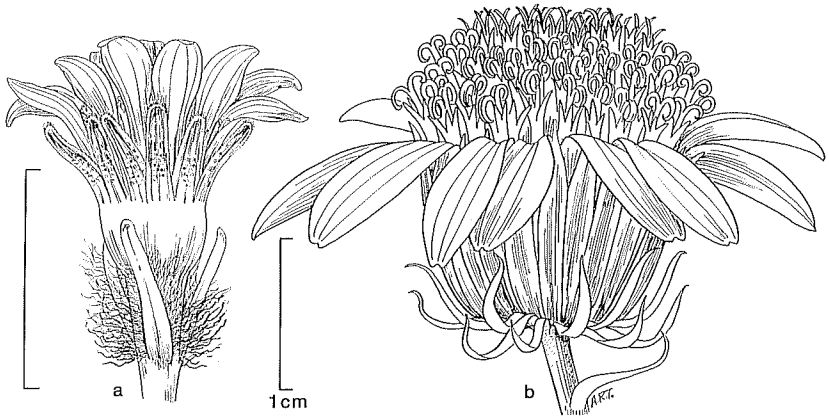


Figure 1. a. Capitulum of *Xenophyllum humile*, note fused involucre bracts and the lack of a calyculus. b. Example of a "typical" Senecioneae capitulum, note free bracts and the presence of a calyculus at the base. Drawings by A. Tangerini (US).

In Ecuador, the species commonly placed into *Werneria s.l.* fall into two easily distinguishable groups. One group is made up of rosette forming plants that are in very small clumps or solitary; this group contains the type species, *Werneria nubigena* (Fig. 2). A second group contains the species that form hummocks or well developed mats and have leaves along the rhizome-like stem. The species in the second group are being moved into a newly described genus, *Xenophyllum* (Funk, in press). The name means "strange or foreign leaves" which fits well the unusual leaves and habit of this new genus (Fig. 3). Also, it is alphabetically close to *Werneria* for the convenience of some who insist on having their herbarium arranged in that manner.

There are nine species of *Werneria* and *Xenophyllum* found in Ecuador, all

of which grow at high elevations, generally above 3200 m, in the páramo and super páramo of the Andes ranging from the provinces of Sucumbíos and Carchi in the north to Loja in the south. Most of the species are found throughout the mountainous areas except for *Xenophyllum roseum* which is endemic to Azuay (and possibly Loja), *Xenophyllum rigidum*, which is confined to the volcanoes Antisana and Chimborazo, and *Xenophyllum crassum* from the north-central area of Andean Ecuador.

Key to the species of *Werneria* and *Xenophyllum* of Ecuador

1. Plants forming rosettes in small groups or often found individually; leaves completely green; leaves few and localized near the apex of the rhizome or just below the head
 2. Ray florets yellow with varying amounts of red on abaxial surface; disk florets yellow; styles yellow; heads often with a slender, red-purple, hairy, peduncle of varying lengths (0.5-10 cm), but usually ca 4-6 cm, with many bracteoles scattered along peduncle (Fig. 2c) *W. pumila*
 2. Ray florets white, sometimes with red on abaxial surface; disk florets yellow, cream or white; styles yellow, cream, white, or red; heads nearly sessile or sometimes with a thick, green, glabrous, short (1-2 cm) peduncle with a few bracts
 3. Leaves arranged in a distichous pattern, apex rounded tips; heads usually large (100-200 disk florets, very rarely 50-75); disk florets and styles always yellow (Fig. 2 a-b) *W. nubigena*
 3. Leaves arranged in a tight spiral, apex pointed; heads small (15-30 disk florets); disk florets varying from yellow to cream or white; styles usually yellow or red, rarely white or cream (Fig. 2 d) *W. pygmaea*
1. Plants forming hummocks or mats; only upper leaves with top few mm green and remainder of leaves brown, black, or rarely white; leaves many and at least the leaf bases covering the rhizomes for about the first 10 cm.
 4. Ray florets bright violet-purple fading through various shades to pale lavender in late flowering and fruiting stages; limb of ray floret elliptical and apex distinctly tapering to a point *X. roseum*
 4. Ray florets white; limb of ray floret oblanceolate, apex rounded and sometimes notched.
 5. Plants with long slender seldom branching rhizome-like stems; leaves very short, 7-8 mm, and spine-like *X. acerosum*
 5. Plants with 2-4 lateral branches in rhizome like stem, almost immediately below the head or apex of the rhizomes; leaves larger, 12-50 mm (except for *X. sotarense*), and at least somewhat flattened.
 6. Plants forming tight hummocks; heads smaller (11-30 disk florets); leaf bases with short wavy hairs not wrapping around rhizomes.
 7. Leaves dark brown or black except for the distal 2-3 mm of the uppermost leaves which are green; heads medium sized (20-30 disk florets); leaves usually 12-20 mm long (Fig. 3 b-c) *X. humile*
 7. Leaves very light brown to white except for the distal 2-3 mm of the uppermost leaves which are green; heads small (11-13 disk florets); leaves 5.0-6.5 mm long *X. sotarense*
 6. Plants forming loose, more or less flat hummocks or open mats; heads larger (40-120 disk florets); leaf bases with long hairs that wrap around rhizomes.
 8. Leaves rather thin, medium green, reflexed just below the head, apex pointed; heads

- with 90-120 disk florets (Fig. 3a) *X. crassum*
 8'. Leaves thick, dark green, stiff and erect, apex rounded; heads with 40-50 disk florets
 (Fig. 3 d) *X. rigidum*

Clave para las especies de *Werneria* y *Xenophyllum* de Ecuador

1. Plantas formando pequeños grupos de rosetas a menudo creciendo solas; hojas completamente verdes; pocas hojas situadas cerca al ápice del rizoma o justo bajo la cabeza.
2. Flósculos del radio amarillos, con diferentes intensidades de rojos en la superficie abaxial; flósculos del disco amarillos, estilos amarillos; cabezas frecuentemente con pedúnculo delgado, rojo-purpúreo, piloso, de longitud variable (0,5-10 cm) pero usualmente (4-6 cm); con muchas bracteolas esparcidas a lo largo de la superficie del pedúnculo (Fig. 2c) *W. pumila*
2. Flósculos del radio blancos, a veces con rojo en la superficie abaxial; Flósculos del disco amarillos, cremosos, blancos; estilos amarillos, cremas, blancos, o rojos; cabezas casi sésiles o a veces con pedúnculos gruesos, glabros, verdes, cortos (1-2 cm) y con unas pocas brácteas.
3. Hojas arregladas en dos filas opuestas (dísticas), ápices con puntas redondas; cabezas normalmente grandes (100-200 flósculos del disco, rara vez 50-75); flósculos del disco y estilo siempre amarillos (fig. 2 a-b) *W. umbigena*
3. Hojas arregladas en un espiral estrecho, con ápice puntiagudo; cabezas pequeñas (15-30 flósculos del disco); color de los flósculos del disco variando de amarillo a blanco o crema; estilos usualmente amarillos o rojos, raramente blancos o cremas *W. pygmaea*
1. Plantas formando montículos o alfombras planas; hojas verdes solo en unos pocos mm distales de las hojas más externas; hojas numerosas y al menos las bases de las hojas cubriendo los rizomas hasta alrededor de 10 cm.
4. Flósculos del radio, violeta-púrpureos marchitándose en varias tonalidades hasta pálido lavanda en las últimas etapas de florecimiento y fructificación; limbos del radio de flósculos elípticos y ápice claramente rematado en punta *X. roseum*
4. Radios del flósculo blancos; limbos del radio del flósculo oblancoeados, ápice redondo y cortados a veces.
5. Plantas cuyos tallos con apariencia de rizomas son largos, delgados y raramente ramificados; hojas muy cortas (7-8mm), semejantes a espinas *X. acerosum*
5. Plantas con 2-4 ramas laterales en el tallo parecido a un rizoma, casi inmediatamente debajo la cabeza o del ápice del rizoma; hojas más grandes, 12-50mm, (excepto en *X. sotarense*), y al menos más aplanadas
6. Plantas en montículos densos; cabezas más pequeñas (11-30 flósculos del disco), las bases de las hojas con pequeños pelos ondulados no enrollados alrededor del rizoma.
7. Hojas marrón-oscuros o negras excepto los 2-3 mm distales de las hojas más prominentes, que son verdes; cabezas medianas (20-30 flósculos del disco); hojas normalmente 12-20 mm de largo (Fig. 3 b-c) *X. humile*
7. Hojas muy ligeramente marrón a blancas excepto los 2-3 mm distales de las hojas más prominentes que son verdes; cabezas pequeñas (11-13 flósculos del disco); hojas 5-6,5 mm de largo *X. sotarense*
6. Plantas formando montículos más o menos planas o en alfombras abiertas; cabezas más grandes (40-120 flósculos del disco); las bases de las hojas con pelos largos que se enrollan alrededor del rizoma.
8. Hojas más bien delgadas, medianamente verdes, puntiagudas y dobladas abruptamente

- mente hacia atrás justo debajo de la cabeza, ápice puntiagudo; cabezas con 90-120 flores del disco (Fig. 3a) *X. crassum*
8. Hojas gruesas, verde oscuras, redondas en las extremidades, tiesas y erguidas, ápice redondeado; cabezas con 40-50 flósculos del disco (fig 3d) *X. rigidum*

Werneria Kunth

Plants found as individual rosettes or in small groups of rosettes that are often connected by rhizomes that grow on or near the surface. Ray florets white or yellow often with red on the adaxial surface, disk florets yellow, white, or cream and styles yellow, red, white or cream. No evidence of a true calyculus but some species with many bracteoles grouped near but not at the base of the head. Involucral bracts fused from 1/4 to 2/3 of their length.

1. *Werneria nubigena* Kunth (Fig. 2a,b) grows alone or in small groups in grassy páramos usually at the base of slopes or up the slope some distance. I have often seen it in open areas just below *Polylepis* forests. It is usually somewhat lower in elevation than other species of *Xenophyllum* or *Werneria*, beginning at 2800 m with most collections below 4000 m. There are a few herbarium sheets from volcán Pichincha whose labels say 4700 meters but I have never seen this species grow at that high an elevation. In Ecuador it is occasional in all of the Andean provinces from Carchi to Loja. This species grows in the Andes from Colombia to Bolivia and even has a few populations in southern Mexico and northern Guatemala. It is the only species of either genus known to occur outside of South America. One often finds many vegetative plants with only a few in flower. Usually it has large heads (100-200 disk florets); rarely it can be quite small (ca. 50 disk florets). While it is easily identified by its head size, it also has distichous leaves, the only species in either genus with this character. In flowering plants the large head usually obscures the leaf bases and as a result the distichous condition is not noticed but it is readily apparent in non-flowering plants. The very small plants are sometimes mixed up with *Werneria pygmaea* (discussed under *W. pygmaea*).

2. *Werneria pumila* Kunth (Fig. 2c) grows in solitary rosettes or in small groups on slopes between 3700 meters and 4800 meters elevation. It is endemic to Ecuador and is most common in the Andes in the north central section of the country with most of the collections in the volcán Pichincha area. In one collection on volcán Chimborazo the plants were found growing out from under a low rock overhang and the rhizomes and leaves were longer than any other collections. However, this species is usually a small plant with a delicate looking slender peduncle that varies in length but is usually obvious, and is usually red in color with white pubescence and has numerous bracte-

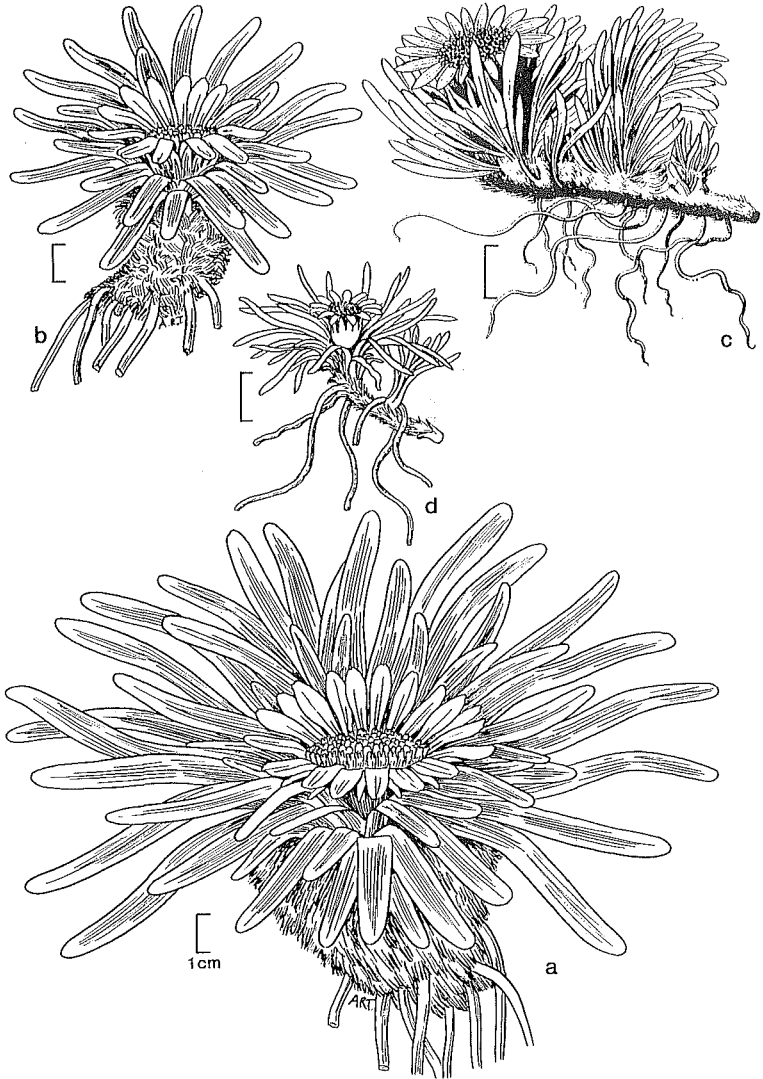


Figure 2. *Werneria* from Ecuador. a-b. *Werneria nubigena*, drawing by A. Tangerini (US). c. *Werneria pumila*, copied from Humboldt *et al.* (1820). d. *Werneria pygmaea*, redrawn from Weddell (1856).

oles. It is the only species in Ecuador with yellow rays.

3. *Werneria pygmaea* Gilles ex H. C. A. (Fig. 2d; syn. *W. apiculata* Sch. Bip., *W. graminifolia* Kunth) grows in rosettes but is usually found with a number of individuals in the same general area often connected by rhizomes at or near the surface of the ground or in shallow water or mud. It grows in flat usually moist areas in a wide range of elevations from Prov. Carchi to Prov. Azuay. It is certainly the most variable taxon in the two genera, with disk florets/style color varying from yellow/yellow, white/red, white/white, cream/cream, and cream/red, but as far as I can tell there are no collections with the yellow/red combination. The leaves vary from short (ca. 10 mm) with an acute apex to long (ca. 30 mm) with more tapering points. Usually the heads are small (20-30 disk florets) and are obviously different from those of *Werneria nubigena*, but there are a few small *W. nubigena* collections that have approximately 50 disk flowers and are sometimes incorrectly identified as *W. pygmaea*. Still, the *W. nubigena* collections always have more disk florets, the disk florets and styles are always yellow, the leaves are distichous, and the blades never have long pointed apices. *Werneria pygmaea* is the most widespread and variable species in either genus, growing from Venezuela to Patagonia at different elevations and in a variety of habitats. As a result it has many synonyms.

Xenophyllum V. A. Funk

Hummock or mat forming plants with green leaves only at the apical end of the rhizomes. Ray florets are white (except for *X. roseum* which has violet-purple ray florets) and the disk florets and styles are yellow. There is no evidence of a calyculus, and bracts of the involucre are fused about half way during early to mid-flowering stages.

4. *Xenophyllum acerosum* (Cuatrecasas) V. A. Funk is only known from the type locality collected by Pietro (P-280) in Azuay between Oña and the Río Yacuambi at 3050-3400 m elevation. It is very different from the other species in *Xenophyllum* because it does not branch near the apex of the rhizomes and so it must form a very loose hummock and from the single collection it appears that it may even be somewhat subshrubby in appearance. The species has small heads and small (7-8 mm) spine-like leaves.

5. *Xenophyllum crassum* (S. F. Blake) V. A. Funk (Fig. 3a) grows in loose mats in more or less flat areas at the base of slopes. It has been collected at 3600-4600 meters elevation on volcán Chiles (Carchi), in the Llanganates

Mountains (Prov. Cotopaxi, Napo, Pastaza), volcán Pichincha and volcán Sincholagua (Prov. Pichincha), páramo Guamaní (Prov. Pichincha and Napo), volcán Sarahurcu, and volcán Antisana (Prov. Napo). It grows from Colombia to central Ecuador. It can be distinguished by its rather large heads (90-120 disk florets) with long white rays and by the long (25-50 mm) pointed leaves that are reflexed except for the few near the apex.

6. *Xenophyllum humile* (Kunth) V. A. Funk (Fig. 3b,c; syn. *W. articulata* S. F. Blake) is usually found in large densely packed hummocks some a meter or more in diameter. It grows in wet páramos but only on slopes and in other drained areas. Although it usually grows in soil or in areas of small rocks, on one very wet páramo in Prov. Morona Santiago it was found hanging on a cliff side and at the summit in the National Park Cajas (Prov. Azuay, 4400 m) it was seen growing on a rock. It is common throughout the Andes in Ecuador at 3200-4700 meters elevation stretching from Prov. Carchi to Loja. The species is known from central Colombia to northern Peru with one isolated collection in northern Bolivia. It is quite variable with some larger plants having leaves that are 25 mm long and heads that have 30 disk florets while the smallest ones have leaves 12 mm long and 20 disk florets. In Ecuador, it is the most commonly collected species of the genus and one of the most commonly collected Compositae. Its tight hummocks, medium green leaves, and copious lateral roots leading into the decaying leaves of other parts of the hummock are a familiar sight on the páramos.

7. *Xenophyllum rigidum* (Kunth) V. A. Funk (Fig. 3d) grows in loose hummocks in rocky sparsely vegetated areas. Endemic to Ecuador, it is found at the highest elevations, 4000-5100 meters, on volcán Antisana (Prov. Napo) and volcán Chimborazo (Prov. Chimborazo). The species is characterized by its dark green, stiff, erect leaves, and heads that are nearly buried in the foliage.

8. *Xenophyllum roseum* (Hieron.) V. A. Funk grows in somewhat flattened hummocks in flat slightly wet areas of the super-páramo. It is endemic to southern Ecuador and with one exception, all collections are from several localities in the National Park Cajas at 3600-4300 meters (there is one collection by Jameson without specific locality from Loja). It was thought by some workers to be a synonym of *Werneria humilis* but field observations make its distinction clear. In addition to growing in a different type of habitat, it has violet-purple ray florets that are elliptical with long pointed apices and its leaves are round in cross-section.

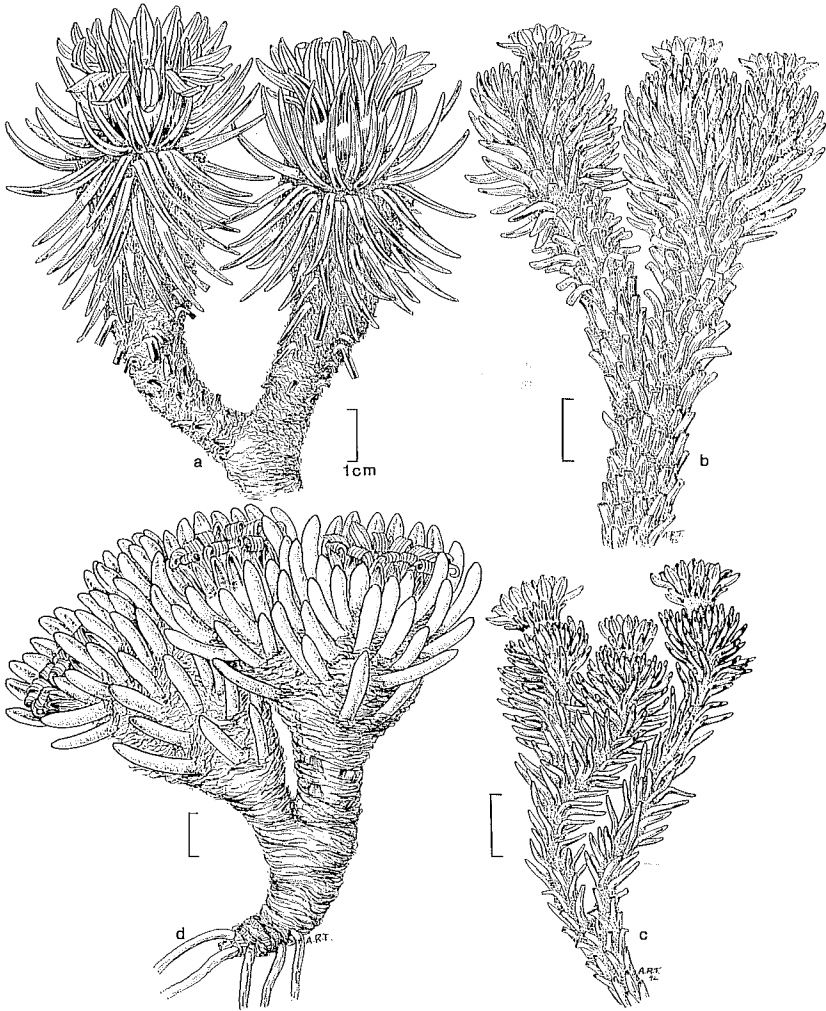


Figure 3. *Xenophyllum* from Ecuador, note unusual leaves for members of the Compositae. a. *Xenophyllum crassum*. b-c. *Xenophyllum humile*. d. *Xenophyllum rigidum*. Drawings by A. Tangerini (US).

9. *Xenophyllum sotarense* (Hieron.) V. A. Funk grows in hummocks in very wet flat or slightly sloping areas in high elevation areas of volcán Antisana (4500 m, Prov. Napo) and areas above Soldados in the National Park Cajas (3800 m, Prov. Azuay). It is also known from southern Colombia. The species is sometimes placed in synonymy with *Xenophyllum humile* but can be distinguished by the white color of all but the uppermost leaves, the very small size of the leaves and heads, and the fact that the hummocks are not tightly packed as they are in *Xenophyllum humile*. It also grows in much wetter areas of the páramo.

Species of *Werneria* and *Xenophyllum* can be found near one another but they always seem to be separated by some characteristics of the habitat. A good example can be found on páramo del Angel in the provincia del Carchi, where three species are found close together. On the slopes leading down to the lake there are vivid green, often large, hummocks of *Xenophyllum humile* with their tightly packed, hard surface with few if any other types of plants growing in them. A few meters lower down at the base of the slope is *X. crassum* growing in smaller looser more flat hummocks with a few species from other families. Out on the mudflat at the waters edge is *Werneria pygmaea* with its red rhizomes snaking all over the area either just below the surface of the mud or in shallow water. This species freely intermingles with many other species of plants. This type of association of species is found repeatedly throughout Ecuador.

Summary

Werneria and *Xenophyllum* have species that are frequently found on the páramos and superpáramos of Ecuador. The species of *Xenophyllum* that are found in Ecuador are restricted to southern Colombia and Ecuador with a few collections of *X. humile* from northern Peru that have very small leaves and one robust collection from northern Bolivia. The species remaining in *Werneria* can be divided into two groups, the white rayed ones that are widespread and variable (*W. nubigena* and *W. pygmaea*), and the yellow rayed one that appears to be restricted to Ecuador but probably is closely related to *W. villosa* of Peru and Bolivia. Additional study of the remaining 30-40 species of *Werneria s.l.* will provide additional insight into the monophyletic groups and the relationships of the species assigned to those groups.

Acknowledgements

I appreciate all the assistance I have received in support of my efforts to locate and study the species of *Werneria s.l.* found in Ecuador. In particular, QCA and QCNE provided invaluable assistance as did the herbarium and students at the Universidad de Azuay in Cuenca. This project would not have been possible without field work. Funding for collecting expeditions was provided by the National Geographic Society and two funds from the Smithsonian Institution: the Scholarly Studies program of the Office of Fellowships and Grants and the Research Opportunity Fund from the National Museum of Natural History. My thanks to M. Fernanda Zermoglio who helped with the Spanish Resumen and Key and Alice Tangerini who did the illustrations.

Literature cited

- BLAKE, S. F. 1928. New South American species of *Werneria*. *Journal of the Washington Academy of Sciences* 18: 485-498.
- FUNK, V. A. in press. *Xenophyllum* Funk, a new genus extracted from *Werneria s.l.* (Compositae: Senecioneae). *Novon*.
- HUMBOLDT, A. VON, BONPLAND, A. & KUNTH, C. S. 1820. *Nova Genera et Species Plantarum. Werneria*. 4: 148-151 plates.
- ROCKHAUSEN, M. 1939. Verwandtschaft und Gliederung der Compositen-Gattung *Werneria*. *Botanische Jahrbucher* 70: 273-339.
- WEDDELL, H. A. 1856. *Chloris Andina* I, XXXIV. *Werneria*. 6 Plates 16-17.