A NEW SPECIES OF *UROLEUCON* (HOM. APHIDIDAE) ON *ANDRYALA* SPP.: A MULTIVARIATE ANALYSIS

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Abstract

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A study of different biometric data of populations of *Uroleucon* (*U.*) *picridis* (F., 1775) sensu lato using canonical discriminant analysis resulted in the separation of two morphological groups. Exchange of host plants allowed us to conclude that the two groups correspond to two different species: *Uroleucon* (*U.*) *picridis* and *Uroleucon* (*U.*) *mierae* sp.nov. This latter species was described and a key to the identification of both species was given.

Tizado, E.J., et J.M. Nieto Nafría. 1994. Une nouvelle espèce d'*Uroleucon* (Hom. Aphididae) sur des *Andryala*: Une analyse multidimensionnelle. *The Canadian Entomologist* **126**: 1251–1261.

Résumé

Le traitement de différentes séries de données biométriques sur des populations d'*Uroleucon* (*U.*) *picridis* (F., 1775) sensu lato au moyen d'une analyse canonique discriminante a mis en lumière l'existence de deux groupes morphologiques différents. Le remplacement des plantes hôtes a permis de conclure que les deux groupes correspondent à deux espèces: *Uroleucon* (*U.*) *picridis* et *Uroleucon* (*U.*) *mierae* sp.nov. On trouvera ici la description de la nouvelle espèce ainsi qu'une clé d'identification des deux espèces.

[Traduit par la Rédaction]

Introduction

To carry out taxonomic studies on aphids, morphometric characters were used although their use was limited almost exclusively to absolute measurement or the proportions of simple measurements (Eastop and Blackman 1988) or complex ones (Stroyan 1982). These measurements were made up of discrete characters, e.g. the number of setae on different areas of the body or of secondary rhinaria in the antennal segments.

Multivariate analysis has been used successfully in taxonomic studies of various groups of insects and other animals. Wetton (1987) used principal components and canonical variates analysis to identify the various species of Collembola; Thorpe (1979) analyzed, using different multivariate methods, the racial affinities of *Natrix natrix* (L.) in Europe; and Pankakoski et al. (1987) separated populations of muskrat with these methods.

Some workers have used multivariate morphometric techniques to determine the geographic variations of populations in the same aphid species (Sokal and Riska 1981; Foottit and Mackauer 1990), multivariate analysis for phylogenetic studies (Sorensen 1987) or species separations (Blackman and Paterson 1986), or statistical distribution analysis of certain proportions or variables to differentiate subspecies (Blackman et al. 1977).

Antecedents. *Uroleucon* (*U.*) *picridis* (Fabricius, 1775) was considered as a monophagous species on *Picris* sensu lato, but later was seen as being able to develop on other Liguliflorae with yellow flowers. However, it has been suspected that two different biological entities exist under this name: the typical one on *Picris* spp. and one that develops on *Andryala* spp.

Tizado-Morales and Nieto Nafría (1990), using principal component analysis, identified two morphological population groups of *U. picridis*: one from *Picris hieraciodes* L., *P. echioides* L., and *Leontodon hispidus* L.; and the other from *Andryala* spp. and *Hispidella*

TABLE 1. Quantitative and discrete variables studied. Those variables used in the multivariate analysis are indicated by an asterisk (abbreviations used in the text in parentheses) and the coefficients of the first two discriminant functions calculated (F_1 and F_2) for the grouped aphids depending on the five plant species

F_1	F_2	
2 18.839	2 3.260	(Constant)
2 0.515	5.075	Length of body* (C)
2 1.890	2 1.362	Total length of antenna* (A)
5.487	4.041	Length of hind tibia*
2 15.571	2 20.733	Length of hind femur*
3.202	7.170	Length of siphunculi* (c)
6.449	2 12.852	Length of cauda* (q)
14.977	2 37.380	Length of antennal segment I*
7.900	2 4.365	Length of antennal segment III* (III)
2 17.271	19.976	Length of antennal segment IV* (IV)
		Length of antennal segment V* (V)
32.844	2 2.659	Length of basal part of antennal segment VI* (VIb)
		Length of processus terminalis* (VIpt)
92.960	2.422	Length of apical rostral segment* (r)
2 21.350	2 75.944	Diameter basal of apical rostral segment*
2 3.006	66.896	Length of second segment of hind tarsus* (t)
		Number of hairs on the cauda
		Diameter basal of antennal segment III
		Length of reticulated area of siphunculus
		Number and length of hairs on antennal segment III
		Number of secondary rhinaria on antennal segment III
		Number and length of hairs on abdominl tergite III
		Number and length of hairs on abdominal tergite VI
		Number and length of hairs on abdominal tergite VIII
		Number of hairs on genital plate
		Number of complementary hairs on apical rostral segment

hispanica Barnades ex Lam. To determine if these are two species, a discriminant analysis and interchange of host plants were carried out.

Material and Methods

For the morphometric study, apterous viviparous females were used because in the genus *Uroleucon* this morph provides more data for taxonomic separation. The samples studied came from different locations: from 15 different Spanish provinces and from Algeria, France, and Italy (Sardinia) supplied to us by G. Remaudière. Several of them were recorded as *Uroleucon picridis* by Nieto Nafría (1974, 1976, 1977), Nieto Nafría et al. 1977, Mier Durante (1978), and Robles Blanco and Mier Durante (1985).

We initially included eight discrete variables and 17 quantitative characters (Table 1). The preliminary analysis of the 25 characters, measured on 44 specimens, allowed for the elimination of all discrete variables and two quantitative ones (the length of the reticulated area of the siphunculus and the diameter of antennal segment III) by showing a very wide range of variation or by the non-existence of significant difference between them. The study concluded with the measurement of another 43 specimens, so the final analysis was carried out with 87 specimens, 50 of which belonged to the *Andryala* group (47 samples collected on *Andryala* spp. and 3 on *Hispidella hispanica*) and 37 to the *Picris* group (6 samples on *Leontodon hispidus*, 22 on *Picris echioides*, and 9 on *P. hieracioides*). To calculate the Fisher's linear discriminant function, a total of 112 specimens of *Andryala* group and 53 of *Picris* group were measured.

TABLE 2. Canonical discriminant functions of all data grouped for the five species of plants obtained using the discriminant analysis method

Function	Eigenvalue	Percentage of variance	Canonical correlation
1	10.3528	82.57	0.9549
2	1.4210	11.33	0.7661
3	0.4688	3.74	0.5650
4	0.2962	2.36	0.4780

Canonical Discriminant Analysis. Despite the disadvantage of the need for a previous grouping of individuals, canonical discriminant analysis is an excellent technique for studying populations or racial variation as it can maximize the interpopulation variation in relation to the intrapopulation variation. The criterion chosen in this analysis was the minimization of Wilks' lambda. Thus, at each step the variable that resulted in the smallest Wilks' lambda for the discriminant function was selected for entry. We used the statistical software SPSS/PC + v3.1 to compute the multiple discriminant analysis running in a PC.

Host Plant Transfer. Host plant transfer is a technique frequently used in the study of aphids and it gives good information on their biological characteristics, which are of great importance in aphid taxonomy. The technique consists of collecting adult and young aphids from a plant, transferring them to another plant, and checking to see if they are capable of sustaining themselves, the time they remain on the new plant, if they feed, and if reproduction occurs.

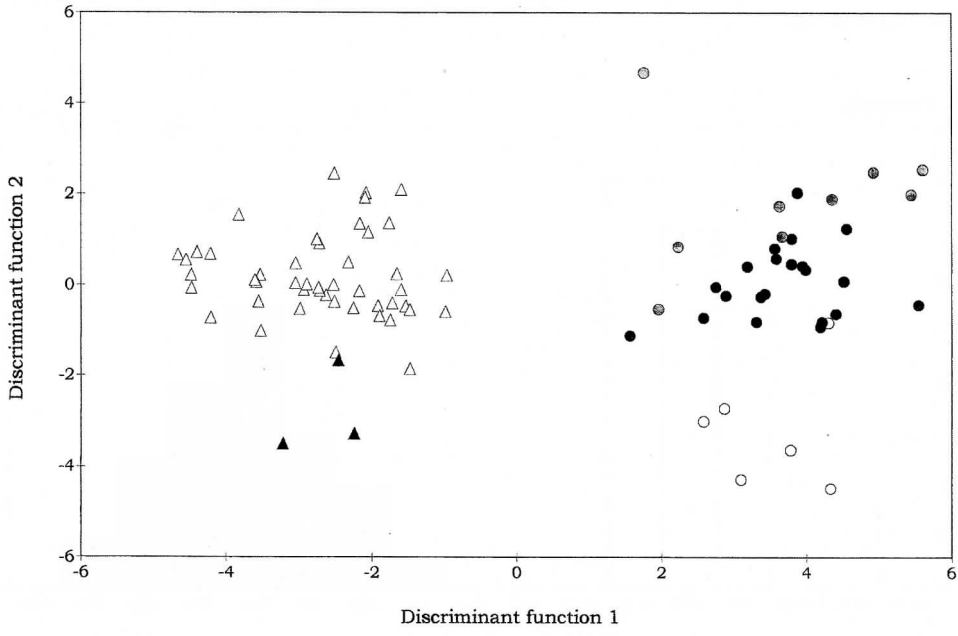

FIG. 1. Plot of all aphid specimens projected onto the first and second canonical axes. *Andryala* group, triangles: black triangles = on *Hispidella hispanica*; white triangles = on *Andryala* spp. *Picris* group, circles: black circles = on *Picris echioides*; gray circles = on *P. hieracioides*; white circles = on *Leontodon hispidus*.

TABLE 3. Canonical discriminant functions of 40 cases selected for the two groups of plants and classification results of these cases and 47 cases not selected obtained using the discriminant method (n = number of specimens; % = percentage of correct classification)

Function	Eigenvalue	Percentage of variance		Canonical correlation
1	13.3108	100		0.9644
	n	group 1	group 2	%
Selected cases				
1. *Andryala* group	20	20	0	100.0
2. *Picris* group	20	0	20	100.0
Not selected cases				
1. *Andryala* group	30	29	1	96.7
2. *Picris* group	17	0	17	100.0

Results

Canonical Discriminant Analysis. With the multivariate methods previously described and using the 15 remaining biometric variables, the samples collected on the five species of plants mentioned were initially analyzed, thus obtaining four canonical discriminant functions (Table 2). The first of these accounts for a variation between groups of 91.2% of the total and explains 82.6% of the information of the system, and the second accounts for a variation between groups of 58.7% of the total and, together with the first, accounts for 93.9% of total variation, this value being sufficient for data analysis.

The projections of the individual specimens onto the first two canonical discriminant functions (Fig. 1) show that there clearly exist two defined groups, the *Andryala* group and the *Picris* group.

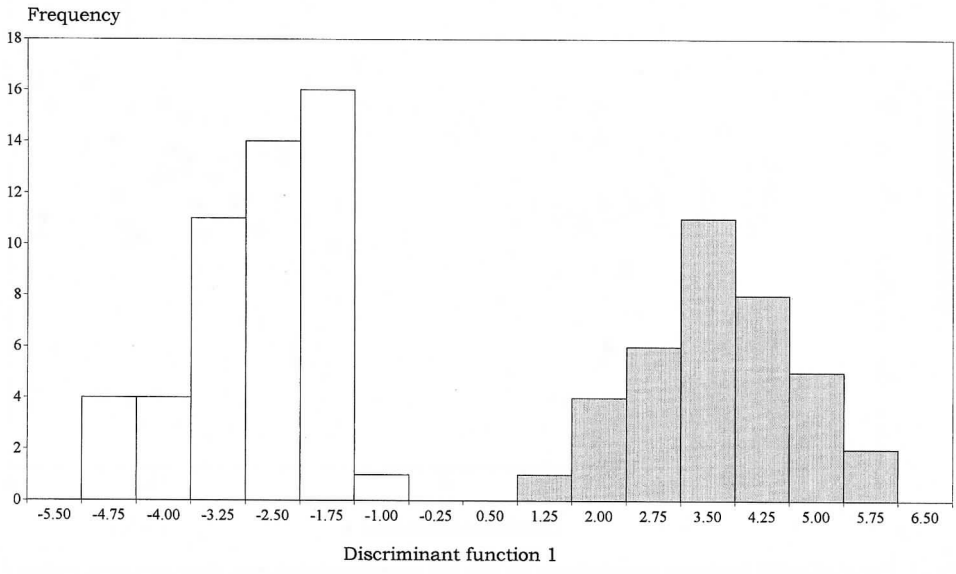

FIG. 2. Frequency distribution of aphid specimens along the first discriminant function axis. White = *Andryala* group; gray = *Picris* group.

The first canonical discriminant function (Table 1) has been fundamentally correlated to the length of the apical rostral segment ($r = 0.53$). From the standardized coefficients, the weight of this function falls on the length of the apical rostral segment, the tibia and the femur of the hind legs, and antennal segment IV. This is the function that morphologically separates the two groups, and the variables that have the greatest weight on this function are those that are the most important in their separation.

The second canonical discriminant function (Table 1) was correlated to the length of the body ($r = 0.48$). Based on the standardized coefficients, the weight falls on the length of the body, the second segment of the hind tarsi, and antennal segment IV. This function separates the individuals in relation to the plant on which they were found for each group. This function shows the variability due to the host plants, and the variables that have the greatest weight are those most influenced by the characteristics of the plants.

Finally, and taking into account the two defined groups, the canonical discriminant functions using 20 specimens randomly selected from each group were calculated. This analysis allowed us to establish the lengths of the apical rostral segment and antennal segment IV as major variables for separating both groups. Table 3 shows the correct classification of this analysis, and the projection of the individual specimens is shown in Figure 2.

Host Plant Transfer. The production of sexuals and the laying of eggs which normally hatched the following spring on both plant species were observed in populations of *Uroleucon* on *Andryala integrifolia* L. and *Picris hieracioides*. Thus, both aphid groups complete a monoecious holocyclic cycle.

Host plant transfer, from *A. integrifolia* to *P. hieracioides* and vice versa, has been tried five times without observing either feeding or reproduction after the change, and with the death of the individuals after a few days. When the aphids were transferred from *P. hieracioides* to *A. integrifolia* many of them fell from the plant after a few minutes, showing their inability to live on these plants.

Discussion

There exist sufficient morphological differences to differentiate the viviparous apterous females of the two groups with a low percentage of error. These differences are basically due to the length of the apical rostral segment, which, according to Moran (1987), is variable because it is correlated to the type of plant on which the species lives. It is longer in those species that feed on plants with long and thick hairs.

Aphids of the *Picris* group have a very long apical rostral segment due to the presence of simple, somewhat stiff hairs and to the thickness of the epidermis of these plants. Aphids of the *Andryala* group also have a long apical rostral segment owing to the presence of stellate and thick hairs on *Andryala* spp. However, it is not as long as the *Picris* group probably because the plant hairs are not long and the plants are not so strong and have a thinner epidermis. In spite of this, this variable alone does not allow the two groups to be discriminated (Fig. 3) because there exists an overlap between the high values of the *Andryala* group and the low ones of the *Picris* group.

Moran (1987) points out other important characters dependent on the host plant: length of the second segment of the hind tarsi, which is smaller in those species on plants with thick and long hairs; and body size, which is greater in insects living on tougher plants. Both variables are shown in the second discriminant function which shows the morphological differences of the specimens due to the host plants.

No great differences exist with respect to the second segment of the hind tarsus; the values range between 152 μm in aphids on *Leontodon hispidus* and 172 μm on *Picris hieracioides*, in clear correlation with body size ($r = 0.54$, $p < 0.001$).

If this correlation is analyzed for each group, it can be seen that there is a correlation between these two variables ($r = 0.76$, $p < 0.001$) in the *Picris* group but not ($r = 0.15$,

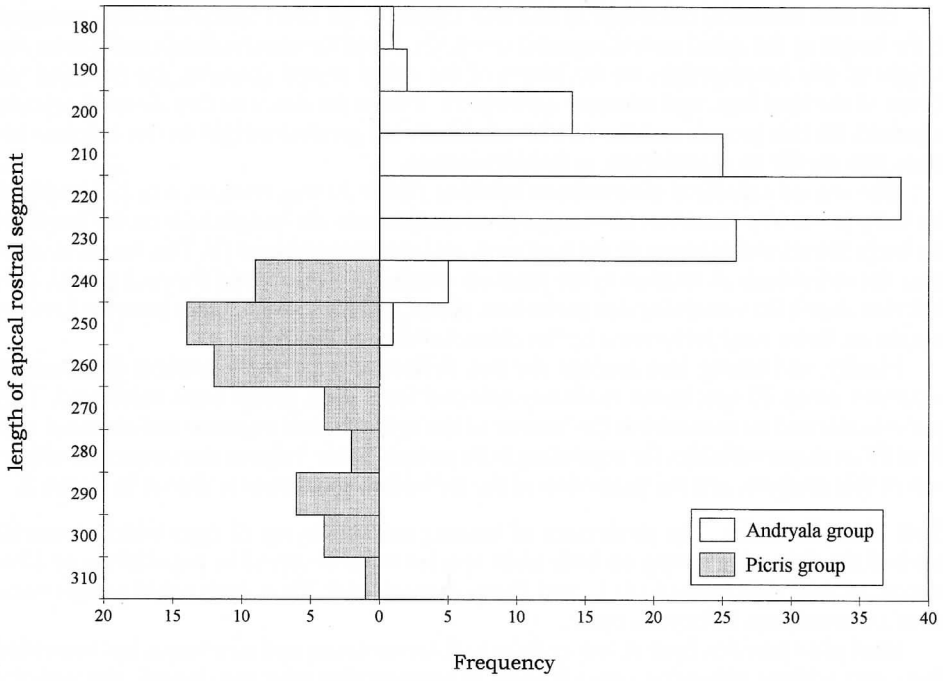

FIG. 3. Frequency distribution of length of apical rostral segment of aphid specimens (in micrometres).

$p = 0.144$) in the *Andryala* group. This different correlation is possibly due to a selection pressure in the latter group whereby individuals with large bodies and long apical rostral segments are eliminated because they cannot feed on a relatively thin plant (*Andryala* spp.). This fact can be graphically demonstrated by the skewness of the length of the apical rostral segment distribution (Fig. 3).

Holman (1981) used the proportions between the apical rostral segment and the second segment of the hind tarsi (rostral index: r/t) and between the former and the length of antennal segment I (ratio r/I). The average values for the rostral index were significantly different — 1.63 in the *Picris* group and 1.41 in the *Andryala* group ($t_s = 2.96$; $p < 0.01$). The ratio r/I, with average values of 1.61 and 1.42 ($t_s = 2.08$; $p < 0.05$), respectively, is similar.

The rostral index clearly indicates the adaptation of these groups to their host plants. Both groups have high values for the species of the subgenus *Uroleucon* that develop on Asteraceae Lactuceae, but lower than the even more specialized species, which live on Inuleae, whose values increase up to 1.9. Despite differences in these average values, there exists considerable overlap of individual values. Thus, the use of other variables for discrimination, such as in lengths of the apical rostral segment and antennal segment IV, was preferred.

Both lengths were the variables that best discriminate the two groups. However, because separation between antennal segments III and IV is a secondary process during development and the unit of growth is made up of both segments (Holman 1987; Holman and Kindlmann 1987), we think that it is better to use the sum of the lengths of both antennal segments to discriminate these groups (Fig. 4).

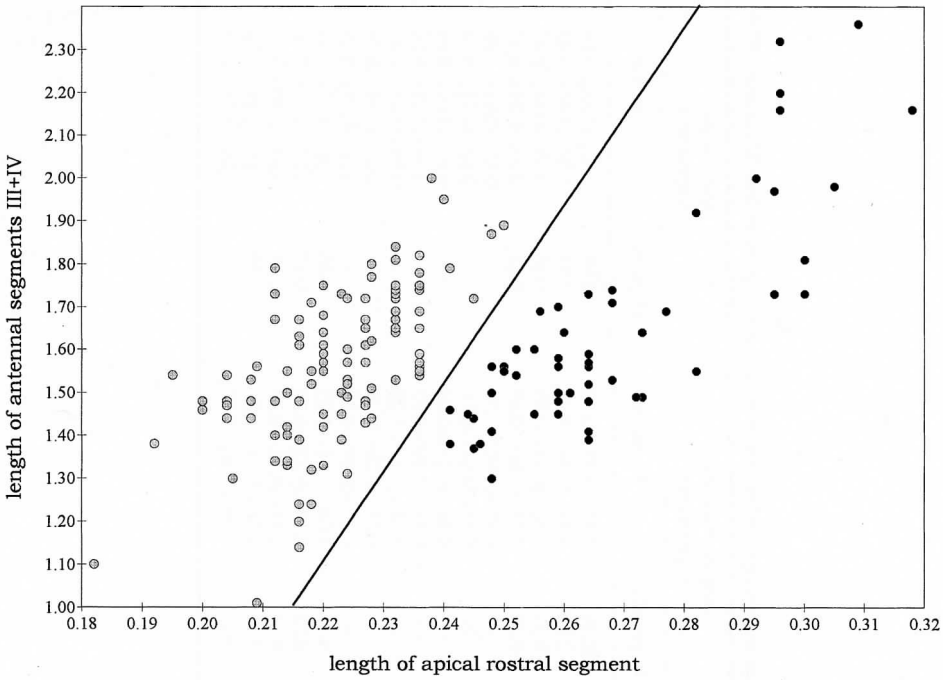

FIG. 4. Relationship between lengths of rostral apical segment and antennal segments III+IV (dimensions in millimetres) of aphid specimens. Solid line is Fisher's linear discriminant function; black circles = *Uroleucon picridis*; gray circles = *Uroleucon mierae* sp.nov.

Conclusion

The morphological differences given by the principal component analysis (Tizado-Morales and Nieto Nafría 1990), by the canonical discriminant analysis, and by the host plant test have allowed us to conclude that the two groups of *Uroleucon picridis* sensu lato correspond to two distinct species: *Uroleucon* (*U.*) *picridis* (F., 1775) which, up until now, has been called the *Picris* group, and *Uroleucon* (*U.*) *mierae* sp.nov. corresponding to the *Andryala* group.

Uroleucon picridis is a well-known European species which characteristically lives on *Picris* spp. and, in Spain, also on *Leontodon hispidus*. Hille Ris Lambers (1939) gave a complete description of all morphs. No differences were found between the values given by him for the viviparous apterous females and those obtained by us for *U. picridis*, except for the number of setae on the cauda (from 14 to 19 according to H.R.L. and from 11 to 20 on our specimens), and the number of secondary rhinaria on the third antennal segment (from 45 to 60 according to H.R.L. and from 25 to 45 on our specimens).

Uroleucon (*U.*) *mierae* sp.nov.

The viviparous apterous and alatae females, oviparous apterous females, and alatae males are morphologically similar to the corresponding morphs of *U. picridis* in color (red brown to dark brown in females and dark green in males), distribution, shape and size of the sclerites, and chaetotaxy.

In Table 4 the diverse absolute measurements and proportions (range and average) of each morph of *U. mierae* sp.nov. are given and compared with the measurements given by Hille Ris Lambers (1939) for *U. picridis*.

TABLE 4. Biometric variables (see Table 1 for abbreviations) of *Uroleucon* (*U.*) *mierae* sp.nov. (range and average) and of *Uroleucon* (*U.*) *picridis* given by Hille Ris lambers (1939)

	Apterous viviparous females (50 specimens)		Alatae viviparous females (10 specimens)		Oviparous females (9 specimens)		Alatae males (6 specimens)	
Variable	*U. picridis*	*U. mierae*	*U. picridis*	*U. mierae*	*U. picridis*	*U. mierae*	*U. picridis*	*U. mierae*
C	3.50	2.45–(3.10)–3.78	3.31	3.60–(4.01)–4.58	2.39	3.13–(3.38)–3.78	1.98	2.53–(2.84)–3.05
A	3.70	2.45–(3.34)–3.83	3.83	4.15–(4.59)–4.98	2.80	3.48–(3.84)–4.28	2.87	3.38–(3.66)–3.85
c	0.98	0.53–(0.76)–0.90	0.83	0.91–(0.95)–1.06	0.59	0.65–(0.73)–0.89	0.33	0.39–(0.43)–0.45
q	0.63	0.42–(0.53)–0.62	0.49	0.55–(0.61)–0.64	0.39	0.56–(0.60)–0.65	0.21	0.23–(0.28)–0.31
III	—	0.64–(0.96)–1.14	—	1.22–(1.32)–1.41	—	0.91–(1.04)–1.23	—	0.88–(0.94)–1.00
IV	—	0.38–(0.61)–0.75	—	0.76–(0.89)–0.98	—	0.55–(0.64)–0.71	—	0.62–(0.71)–0.78
V	—	0.38–(0.50)–0.59	—	0.65–(0.73)–0.77	—	0.49–(0.57)–0.63	—	0.54–(0.60)–0.68
VIb	—	0.14–(0.17)–0.21	—	0.21–(0.24)–0.27	—	0.19–(0.20)–0.22	—	0.16–(0.18)–0.20
VIpt	—	0.69–(0.88)–1.07	—	0.97–(1.15)–1.29	—	1.04–(1.11)–1.29	—	0.93–(1.03)–1.09
r	—	0.20–(0.23)–0.25	—	0.27–(0.29)–0.31	—	0.24–(0.26)–0.29	—	0.24–(0.24)–0.25
t	—	0.14–(0.16)–0.18	—	0.20–(0.21)–0.22	—	0.17–(0.19)–0.20	—	0.18–(0.18)–0.19
A/C	1.10	0.88–(1.08)–1.43	1.20	1.05–(1.15)–1.23	1.17	1.04–(1.14)–1.25	1.45	1.28–(1.31)–1.34
c/C	0.22–0.29	0.21–(0.25)–0.30	0.25	0.21–(0.24)–0.26	0.25	0.19–(0.22)–0.24	0.17	0.14–(0.15)–0.16
q/C	0.18	0.14–(0.17)–0.21	0.15	0.14–(0.15)–0.18	0.16	0.17–(0.18)–0.19	0.11	0.09–(0.10)–0.11
c/q	1.50–1.60	1.18–(1.43)–1.68	1.69	1.46–(1.56)–1.73	1.51	1.11–(1.23)–1.37	1.50	1.45–(1.58)–1.70
r/t	1.51–1.84	1.19–(1.42)–1.58	—	1.33–(1.41)–1.47	—	1.34–(1.40)–1.52	—	1.28–(1.31)–1.33

Biologically, *Uroleucon mierae* sp.nov. is a species that characteristically develops on *Andryala* spp. in Spain, but also on *Hispidella hispanica* and, presumably, on other Liguliflorae Compositae in other areas.

Derivatio nominis: The species is named in honor of the aphidologist M.P. Mier Durante (Departamento de Biología Animal, Universidad de León) who collected most of the samples of the type material.

Type Material. *Holotype*, viviparous apterous female, SPAIN: Cuenca prov., Uña, on *Andryala ragusina* L., 9.x.1974 (Dpto. Biología Animal, Universidad de León, Spain).

Paratypes: 664 viviparous apterous females, 112 viviparous alatae females, 26 oviparous apterous females, 13 alatae males, SPAIN: Ávila prov., Candeleda, 29.vi.72, El Tiemblo, 29.vi.72, Las Parras, 27.vi.72, 4.vi.72; Cáceres prov., Río Malo, 17.x.71, San Martín de Trevejo, 11.vi.72; León prov., Alija del Infantado, 9.vi.78, Astorga, 21.vi.78, Candín, 4.vii.87, Carrizo de la Ribera, 14.vi.78, Folgoso de la Ribera, 28.vi.78, Genestacio, 5.vii.80, Jiménez de Jamuz, 5.vii.80, Lugón, 11.vii.78, Molinaseca, 22.vi.78, Murias de Paredes, 4.vi.87, Nocedo de Curueño, 10.vii.78, Ocera, 28.vii.86, Peñalba de Santiago, 22.vi.78, Ponferrada, 22.vi.78, Quintanilla de Losada, 15.vi.78, Santa Cristina de Somoza, 21.vi.78, Sigüeya, 27.vi.78, Toreno, 28.vi.78, Truchas, 15.vi.78, Villadangos del Páramo, 9.vi.78; Lugo prov., Montefurado, 6.vi.79; Orense prov., Allariz, 15.vi.80, Bande, 28.vi.77, Carballeda, 24.vi.75, Cortegada, 29.vi.77, Castelo del Valle, 27.vi.75, El Barco de Valdeorras, 25.vi.75, Fiscal, 30.vi.77, La Bola, 29.vi.77, Nogueira de Ramuín, 30.vi.77, Oimbra, 28.vi.77, Puente Río Grau, 17.v.78, Ribavia, 29.vi.77, San Justo, 26.vi.78, Santiagoso, 30.vi.77, 9.vii.80, Verín, 27.vi.75, Viana do Bollo, 24.vi.75, Villadequintas, 26.vi.78; Santander prov., Vega de Liébana, 4.ix.73; Salamanca prov., Béjar, 20.vii.70, Cabrerizos, 8.v.77, Ciudad Rodrigo, 18.vi.77, Las Batuecas, 16.vi.72, Ledesma, 5.vii.77, Mogarraz, 1.vii.78, Peunte del Alagón, 16.vi.72, 27.vi.71, 17.x.71, Salamanca, 23.vi.74, Salto de Saucelle, 26.v.72, Santibáñez de la Sierra, 2.vi.74, Saucelle, 19.v.74; Toledo prov., Cortijillo de Hoyas, 8.vi.85; Zamora prov., Alcañices, 11.vi.74, Asturianos, 25.ix.73, Cernadilla, 12.vi.74, Cobreros, 12.vi.74, Cubo de Benavente, 25.ix.73, Cubo del Vino, 29.ix.73, Espadañedo, 18.vi.74, Fermoselle, 29.v.74, Ferreras de Abajo, 18.vi.74, Ferreras de Arriba, 16.v.75, Figueruela de Sayago, 27.v.73, Fonfría, 31.v.73, Fornillos de Fermoselle, 11.vi.75, Granja de Moreruela, 25.vi.73, Mahide, 11.vi.74, Manzanal de Arriba, 7.x.74, Moraleja de Sayago, 27.v.73, Moralina, 11.vi.75, Otero de Bodas, 19.vi.75, Pedralba de la Pradería, 21.vi.75, Pino, 31.v.73, Puebla de Sanabria, 12.vi.74, Requejo, 13.vi.74, Riofrío de Aliste, 15.vi.74, 16.vi.75, Robleda Cervantes, 12.vi.74, Rosinos de la Requejada, 20.vi.75, Samir de los Caños, 11.vi.74, Santa Croya de Tera, 18.vi.74, Trabazos, 12.vi.75, Villardeciervos, 11.vi.74, 27.vi.75, Villadepera, 11.vi.75, 25.v.73, Villar del Buey, 29.v.74; ALGERIE, iv.1960; all on *Andryala integrifolia* L.; Almería prov., Los Yesos, 26.v.80, Uleila del Campo, 26.v.80; Cádiz prov., El Bosque, 14.vi.84; Cuenca prov., Ciudad Encantada, 9.x.74, La Toba, 8.x.90; Uña, 9.x.74; Granada prov., Capileira, 28.vi.84, Cástaras, 28.vi.84, Lanjarón, 28.vi.84, Pampaneira, 28.vi.84, Puerto de la Mora, 26.vi.84, Puerto del Zegrí, 29.vi.84, Trevélez, 28.vi.84; Huesca prov., Arán, 26.vi.89; León prov., Carrizo de la Ribera, 14.vi.78, Friera, 27.vi.78; Madrid prov., El Paular, 22.viii.61; Salamanca prov., Aldeadavila, 28.v.78; Zamora prov., Peñausende, 6.vi.75, all on *Andryala ragusina* L.; Santa Cruz de Tenerife prov., Gomera island, Agulo, 20.x.76, on *Andryala pinnatifida* Aiton; León prov., Losadilla, 15.vi.78, on *Hispidella hispanica* Barnades ex Lam.; FRANCE: Landes, Treusacq, 30.vi.51, Rhône, Condrige, 1.ix.51, and Gironde, Jauge, 1.x.54, all on *Andryala sinuata* L. (Departamento de Biología Animal, León University, León, Spain; Museum Nationale Histoire Naturelle, Paris, France; National History Museum of London, England; Istituo di Entomologia, Catania University, Catania, Italy; Estaçao Agronómica Nacional, Oeiras, Portugal).

Identification of *Uroleucon* (*U.*) *mierae* sp.nov. According to our analysis, the separation of both species must first be based on the absolute length of the apical rostral segment whose average value is 269 ± 6 μm in *Uroleucon picridis* (range: 241–318μm) and 226 ± 3 μm in *Uroleucon mierae* sp.nov. (range: 195–250 μm). Because the greatest standard error of the average is 6 μm, we can establish that there probably exists an overlap in the length of apical rostral segment somewhere between the values 235 and 256 μm, which means that the discriminant value (Fisher's linear discriminant function) should be used to separate both species:

$$D = 387.95 \times r - 18.78 \times (III+IV)$$

where r is the length of the apical rostral segment and III+IV is the combined length of antennal segments III and IV (all measurements in millimetres).

Key to species:

1. Length of apical rostral segment greater than 256 μm ..... *U. picridis*
1′. Length of apical rostral segment less than 256 μm..... 2

2. Length of apical rostral segment less than 235 μm..... *U. mierae* **sp.nov.**
2′. Length of apical rostral segment greater than 235 μm 3

3. *D* greater than 64.81 ..... *U. picridis*
3.′. *D* less than 64.81 ..... *U. mierae* **sp.nov.**

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