

CONTRIBUTIONS TO THE STUDY OF TURKISH GRASSES, I

MUSA DOĞAN*

ABSTRACT. A new monotypic genus, *Pseudophleum* M. Doğan, is described to accommodate *Phleum gibbum* Boiss. Four new species, *Apera baytopiana* M. Doğan, *Apera triaristata* M. Doğan, *Gaudinopsis huber-morathii* M. Doğan, and *Gaudinopsis sorgerae* M. Doğan, are described and illustrated. A count of $2n = 14$ was obtained from root-tips of *Apera baytopiana*. New combinations are published in *Alopecurus*, *Calamagrostis*, *Gaudinopsis*, *Helictotrichon*, *Phleum* and *Zingeria*. In addition, records of five other species new to Turkey (*Aira praecox* L., *Alopecurus davisii* Bor., *Anthoxanthum aristatum* Boiss., *Arrhenatherum kotschy* Boiss., and *Trisetum sibiricum* Rupr.) are listed.

PSEUDOPHLEUM: A NEW GENUS FROM TURKEY

Phleum gibbum Boiss. is endemic to a rather small distribution area in W and adjacent C Anatolia. It was first described by Boissier in his *Diagnoses Pl. Orient. Nov. Ser.* 1(5): 69 (1844), and although he suggested that it might belong to a new genus (*Phalarella*, nomen), he evidently realised that any resemblance to *Phalaris* was purely superficial. He accepted it as a species of *Phleum*, both in his *Diagnoses* and in *Flora Orientalis*. Since then no work has been published on the generic position and relationships of this plant.

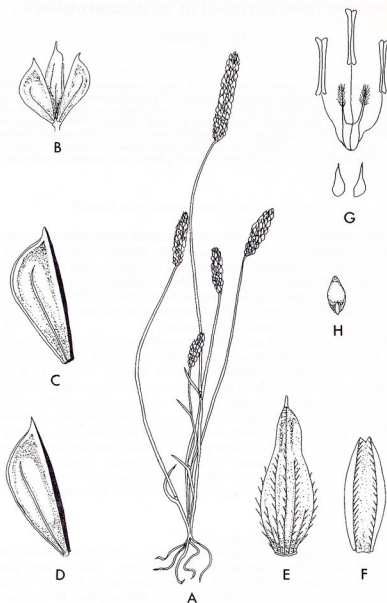
Comparative studies have persuaded me that *Phleum gibbum* Boiss. should be treated as a new monotypic genus: *Pseudophleum* M. Doğan. As shown in Table 1, it holds a somewhat intermediate position between *Phleum* L. and the monotypic genus *Rhizocephalus* Boiss. However, it also possesses differences from both the latter genera — notably the convolute leaves, more or less unequal glumes, a keeled lemma bearing setulose hairs, and a terminal awn. To combine both *Rhizocephalus* and *Phleum gibbum* in *Phleum* would be to destroy the morphological coherence of the latter genus, which contains a total of 16 species. To combine *Phleum gibbum* with *Rhizocephalus* would result in a heterogeneous ditypic group. The only acceptable procedure is to treat *Phleum gibbum* as a separate monotypic genus, *Pseudophleum*, showing affinities with both the other genera.

Pseudophleum M. Doğan, gen. nov. Fig. 1.

Genus affinis *Phleo* L. et *Rhizocephalo* Boiss. A *Phleo* L. glumis spicula brevioribus inaequalibus superne lateraliter gibbosis versus apicem acutis, lemmate glumis longiore ad tertiam partem superiorem dorsaliter carinato coriaceo venis et marginibus setulosis differt. A *Rhizocephalo* Boiss. panicula cylindrica haud involucreta glumis plus minusve inaequalibus venis ad apicem liberis, lemmate dorsaliter setuloso, staminibus tribus, lodiculis duobus recedit.

Herba annua. Lamina foliorum convoluta. Ligula membranacea. Panicula spiciformis. Spicula uniflosculosa, lateraliter compressa, hermaphrodita. Glumae lemmate breviores inaequales, cuneato-naviculares, lateraliter compressae, ad margines superne rectae, superne lateraliter gibbosae, breviter rostratae, ad basin brevissime connatae. Lemma oblongum, ad tertiam partem

*Dept of Botany, Univ. of Edinburgh, at Royal Botanic Garden, Edinburgh EH3 5LR.



M. Doğan

FIG. 1. *Pseudophleum gibbum*: A, habit; B, spikelet; C, lower glume; D, upper glume; E, lemma from dorsal view; F, palea; G, flower; H, caryopsis. A $\times \frac{1}{2}$, B $\times 6$, C-H $\times 13$.

TABLE I

	Phleum	Pseudophleum	Rhizocephalus
Life form	Annual/perennial	Annual	Annual
Leaf blade	Flat	Convolute	Flat
Glumes	Equalling spikelet Equal Shortly acuminate to aristate Veins free at apex	Shorter than spikelet $\pm$ Unequal Acute Veins free at apex	Shorter than spikelet Equal Acute Veins united at apex
Lemma	Rounded dorsally Hyaline Apex obtuse to truncate Clavate & short acuminate hairs on dorsal surface, or glabrous	Keeled in upper half Coriaceous Terminally awned Long acuminate hairs (tapering to a point) on dorsal surface	Rounded dorsally Coriaceous Terminally mucronate Clavate hairs on dorsal surface
Lodicules	2	2	0
Stamens	3 (rarely 2)	3	2
Caryopsis	Subacute at apex	Subacute at apex	Long-acuminate at apex

superiorem sensim angustatum et carinatum, dorsaliter 5-nervosum, terminaliter brevistaratum, praecipue in duobus partibus inferioribus secus nervos et ad marginem setulis instructum. Palea bicarinata, emarginata, ad marginem setulifera, lemmatem aequans. Rhachilla supra glumas disarticulans. Lodiculae 2. Stamina 3. Ovarium glabrum. Caryopsis ovoidea, hilo lenticularae minuto. Genus monotypicum.

Type: *Pseudophleum gibbum* (Boiss.) M. Doğan.

***Pseudophleum gibbum* (Boiss.) M. Doğan, comb. nov. Fig. 1.**

Syn.: *Phleum gibbum* Boiss., Diagn. ser. 1 (5): 69 (1844).

Annual. Stem 5–20 cm, often solitary, somewhat tufted, usually erect, sometimes slightly geniculate in lower part, reddish, slender, glabrous and smooth, 3–4 noded in lower part. Leaf-blades 0.8–5 cm $\times$ 0.8–1.5 mm, linear-acute when opened-up, usually $\pm$ convolute, scabrid on the margins; sheaths glabrous; ligule 2.5–4 mm, acute. Panicle 0.7–4.3 cm $\times$ 0.4–0.5 mm, cylindrical. Spikelets 2.5–3 mm, cuneate-obovate, rather pale greenish. Glumes navicular, very narrow at the base, rather coriaceous; lower glume 1.8–2.2 mm, upper glume 2.4–2.6 mm. Lemma 2.7–3 mm (incl. aristate point), coriaceous, oblong, dorsally covered by setules; terminal aristate point up to 0.6 mm. Palea 2.6 mm, bifid, ciliate on the nerves. Caryopsis 1.3 $\times$ 0.5–0.6 mm. Hilum elliptical. Fl. June–July.

Type. [Turkey C1 Aydin]: in arenosis regionis superioris Mesogis (Aydin Da.) supra Tralles (Aydin) in consortio *Saponariae mesogitanae*, etc., Boissier (holo. G).

TURKEY. B2 Manisa: Boz Da., 22 vii 1854, Balansa. B2 Uşak: near Kaya Ağıl Köy, SW of Uşak, 7 vii 1857, Balansa; Kara Göl Köy, 7 vii 1857, Balansa. B2/C2 Burdur: between Beyşehir and Şarkikaraağaç, 11 km E of Şarkikaraağaç, 1250 m, 24 v 1975, R. Çetlik (ISTE 33840). B2 Denizli: Yayla Gölü near Buldan, meadows, 29 vi 1965, G. Regel (ISTE 12329).

Endemic to Turkey. E Mediterranean element.

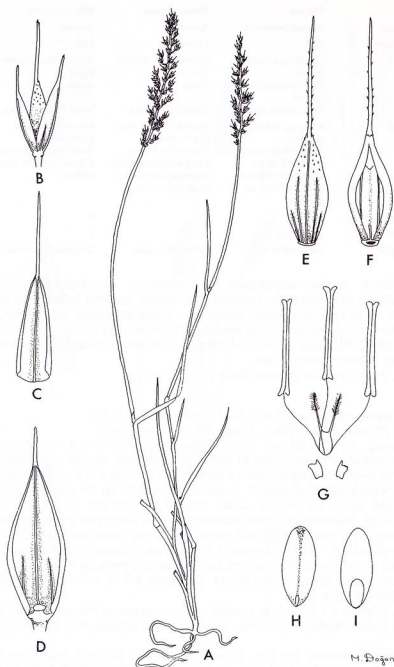


FIG. 2. *Apera baytopiana*: A, habit; B, spikelet; C, lower glume; D, upper glume; E, lemma from dorsal view; F, lemma from ventral view; G, flower; H, caryopsis from ventral view; I, longitudinal section of caryopsis. A $\times \frac{3}{4}$, B $\times 6$, C-I $\times 13$.

***Apera baytopiana* M. Doğan, sp. nov. Fig. 2.**

Affinis *A. triaristatae* M. Doğan sed panicula angustiore minus ramulosa, aristas glumarum magis inaequalibus, arista lemmatis fere terminali 1.2–2.3 mm longa recedit.

Herba annua, viridis. Culmi 16–41 cm longi, plerumque erecti, inferne plus minusve geniculati, solitarii vel fasciculati, aliquantum tenues, glabri, laeves, plerumque 3–4-nodatis. Lamina 2–5.7 cm $\times$ 0.7–1.5 mm, sensim linearis-acuminata, in pagina superiore scabridula, facie inferiore demum glabra; ligula 1.2–3.7 mm, membranacea, acuminata, posterius lacerata. Panicula anguste oblonga, 2.2–6.2 cm longa, 5–17 mm lata, aliquantum densa sed paulo interrupta; rami subverticillati 4.5–15 mm longi, 2–3-plo ramulosi; pedicelli 0.3–1.1 mm, plus minusve scabri. Spiculae 2.4–2.8 mm longae (aristae exclusae), uniflorae, lateraliter compressae. Glumae marginibus albo-membranaceis, teminaliter aristatae; gluma inferior 1-nervosa, 1.9–2 mm longa, lanceolata, arista 0.8–1.5 mm recta scabridula; gluma superior 3-nervosa, 2.5–2.7 mm, elliptico-lanceolata, arista 0.4–0.7 mm. Lemma 3(–5)-nervosum, dorsaliter rotundatum, 1.5–2.1 mm longum, aliquantum firmum, superne scaberulum; arista fere terminalis, 1–2.3 mm longa, recta et plus minusve scabra. Palea elliptica, binervosa, 1.4–1.6 mm longa. Rhachilla supra glumam disarticulans. Stamina 3. Antherae 1.4–1.8 mm longae. Caryopsis 1.2–1.5 mm longa, elliptica; hilum ellipticum minutum. $2n = 14$. Fl. Jun. *Riversides*.

Typus. [Turkey C2 Muğla]: Köyceğiz to Gökova, Karaböğürtlen, 30 vi 1979, E. Leblebici, Ö. Seçmen & L. Bekat 2857 (holo. EGE; iso. ISTE 43921, E).

Cultivated specimen from seed of holotype grown at RBG Edinb., C13584 (E).

This species was collected from SW Anatolia (C2 Muğla) in 1979 by a group of Turkish botanists from Ege University (Izmir). When first examined it was thought to belong to a new genus since it differed from *Apera* in two important characters: a) both glumes were terminally awned; and, b) the awn of the lemma was attached at the apex instead of below. However, later examination of specimens grown in cultivation from seed revealed some spikelets with subterminal lemma awns, and it appears the awn position varies slightly from specimen to specimen, and even according to age within a single specimen. Ideas on the taxonomic significance of terminal awns on the glumes were also modified by the discovery of *Apera triaristata* M. Doğan which has such awns well-developed — previously the concept of the genus was based solely on three species, of which only *Apera intermedia* Hack. with a short awn on the upper glume showed any sign of this character. Thus it was realised that the new species is correctly accommodated in *Apera* rather than a new genus.

Apera baytopiana resembles *Apera triaristata* M. Doğan and *Apera intermedia* Hack. in the glabrous callus of its lemma and its aristate glumes, but in *A. intermedia* only the upper glume has a terminal awn (c. 0.4–0.6 mm). It differs from *Apera triaristata* in having shorter awns on the glumes (see Table 2).

A chromosome count of $2n = 14$ was obtained from seedling root-tips.

The species has been named after Prof. Dr Asuman Baytop of Istanbul University, Pharmacy Faculty, who sent this specimen to me together with part of her rich Turkish grass collections, and to whom I am greatly indebted for her co-operation and kindness.

TABLE 2

Spikelet and floral characters distinguishing all known species of *Apera*

Species	Spikelet mm	Lower Glume			Upper Glume			Lemma			Anther mm
		Length mm	Apex	Awn mm	Length mm	Apex	Awn mm	Length mm	Awn mm	Callus	
<i>A. spica-venti</i>	2.5-3.6	2.2-2.8	Acute	Absent	2.5-3.1	Acute	Absent	2.1-2.8	Clearly subterminal 5.4-8.4	Minutely hairy	1-1.5
<i>A. interrupta</i>	2-2.8	2-2.2	Acute	Absent	2.5-2.8	Acute	Absent	2-2.4	Clearly subterminal 4-8	Minutely hairy	0.2-0.4
<i>A. intermedia</i>	2.5-3	2.5-2.7	Acuminate	Absent	2.6-2.8	Terminal awn	0.4-0.6	2.2-2.5	Clearly subterminal 9-9.5	Glabrous	1.2-1.5
<i>A. baytopiana</i>	2.4-2.8	1.9-2	Terminal awn	0.8-1.5	2.5-2.7	Terminal awn	0.4-0.7	1.5-2.1	Terminal or almost terminal 1-2.3	Glabrous	1.4-1.8
<i>A. triaristata</i>	2.6-2.9	1.9-2.1	Terminal awn	2.2-2.9	2.4-2.6	Terminal awn	1.5-1.7	2-2.4	Clearly subterminal 6.5-10	Glabrous	1.5-1.6

***Apera triaristata* M. Doğan, sp. nov. Fig. 3.**

Affinis *A. baytopianae* M. Doğan sed panicula latiore magis ramosa, aristis glumarum minus inaequalibus, arista lemmatis longissima 6.5–10 mm longa differt.

Herba annua. Culmi 15–23 cm longi, erecti vel nodis plus minusve geniculatis, laeves et glabri, solitarii vel caespitosi, 3-nodati. Lamina 4.5–8 cm $\times$ 1.5–2.5 mm, lineari-acuminata, scabridiuscula; vagina glabra. Ligula 4–5 mm, hyalina, acuta. Panicula 2–10 cm longa, 8–25 mm lata, lanceolata vel oblonga; rami 1–2.5 cm, erecti vel patentes ramulosa; pedicelli 0.3–0.8 mm longi, leviter scabridi. Spiculae 2.6–2.9 mm longae (aristae exclusae), lateraliter compressae, uniflorae. Glumae subaequales, terminaliter aristatae; gluma inferior 1.9–2.1 mm longa, lanceolata, 1-nervosa, arista 2.2–2.9 mm longa; gluma superior 2.4–2.6 mm longa, lanceolato-elliptica, acuminata, 3-nervosa, chartacea, arista 1.5–1.7 mm. Lemma 2–2.4 mm longum, 5-nervosum, dorsaliter rotundatum, dorso superne scaberulum, infra apicem aristatum, arista 6.5–10 mm longa, stricta, scabra. Callus glabra. Palea lemmati aequilonga, 2-nervosa, hyalina. Rhachilla supra glumam disarticulans et brevissime producta. Lodicipuli 2. Stamina 3. Antherae 1.5–1.7 mm.

Typus. [Turkey C2 Denizli]: 39 km from Denizli to Acipayam, 1000 m, 16 vi 1954, *A. Huber-Morath* 12496 (holo. Hb. Huber-Morath).

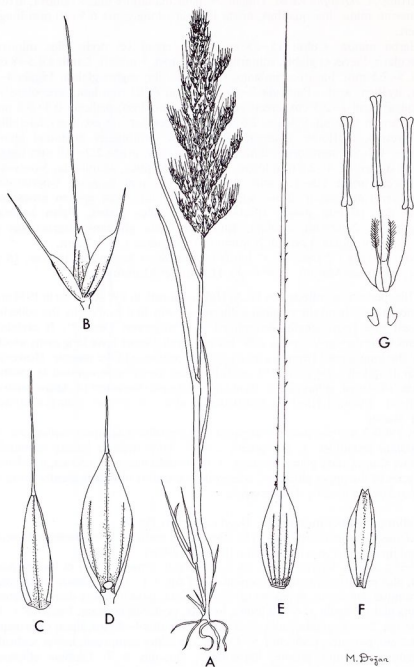
This species was collected by Dr A. Huber-Morath in SW Anatolia in 1954 and is known only from the original gathering. It was first studied by the collector himself and provisionally determined as '*Polypogon* Desf. ?'. It certainly resembles *Polypogon* superficially, because both glumes have long awns which, with the long-awned lemma, give a bristly appearance to the panicle. However, when its spikelets are examined carefully, it can easily be recognized as another species of *Apera*. It has all the floral and vegetative characters of *Apera*, such as glumes 1–3-veined, rhachilla disarticulating above the glumes, lemma acute and chartaceous.

In Table 2 *A. triaristata* is compared with the other four species of *Apera*. *A. triaristata* resembles *A. baytopiana* and *A. intermedia* in having terminally aristate glumes and a glabrous callus. *A. intermedia* has only one awn, which is at the apex of the upper glume. *A. triaristata* is certainly morphologically closer to *A. baytopiana* than to *A. intermedia*.

***Gaudinopsis huber-morathii* M. Doğan, sp. nov. Fig. 4.**

Affinis *G. quercetoro* (Boiss.) M. Doğan sed panicula laxa, lemmate flosculi infimi mucro ad 1 mm longo e sinu instructo differt.

Herba annua. Culmi 16–33 cm longi, erecti, tenues, glabri et laeves; nodi 3–4, plus minusve geniculati. Lamina 6–9.5 cm $\times$ 1–2 mm, lineari-acuminata, plerumque convoluta, in pagina superiore pilosa, facie inferiore demum glabra; vagina glabra; ligula 2–6 mm longa, hyalina, posterius lacerata. Panicula 3–14 cm longa, 2–4.5 cm lata, lanceolata, laxa, contentus 4–40 spiculata; rami usque ad 3.5 cm, patentes; pedicelli 1.5–13 mm, dorsaliter compressi, leviter scabridi. Spicula 8–11 mm longae, lanceolatae, flosculis 6–7. Glumae elliptico-lanceolatae, acutae, 3-nervosae; gluma inferior 4.5–6 mm; gluma superior 6–6.5 mm. Lemma lanceolatum, bifidum, 5-nervosum, in dimidio inferiore adpresse pubescens. Lemma flosculi infimi 5.5–6.4 mm longum, exaristatum, sed mucrone ad 1 mm longo e sinu exoriens, lobis acutis; lemmata flosculorum superiorum 4–7 mm longa, dorsaliter aristata, arista 5.5–6 mm. Palea



M. Doğan

FIG. 3. *Apera triaristata*: A, habit; B, spikelet; C, lower glume; D, upper glume; E, lemma; F, palea; G, flower. A $\times \frac{1}{2}$, B-G $\times 13$.

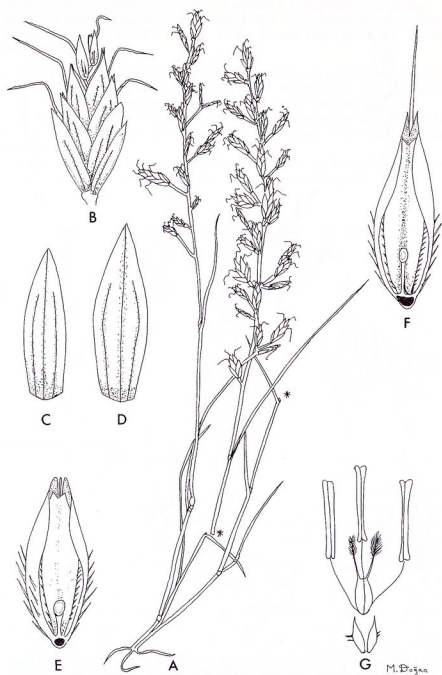
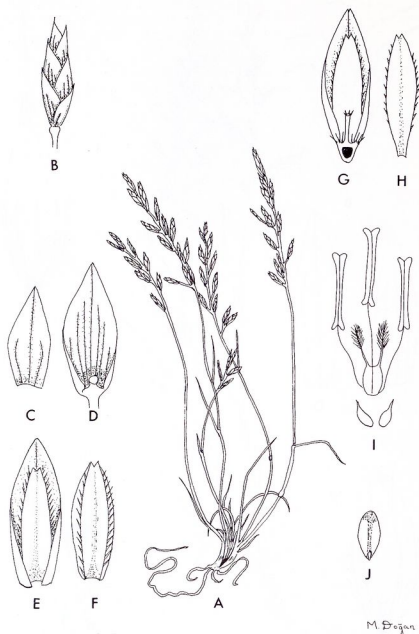


FIG. 4. *Gaudinopsis huber-morathii*: A, habit; B, spikelet; C, lower glume; D, upper glume; E, lowest floret; F, upper floret; G, flower. A $\times \frac{1}{2}$, B $\times 3$, D-C $\times 6$.



M. Doğan

FIG. 5. *Gaudinopsis sorgerae*: A, habit; B, spikelet; C, lower glume; D, upper glume; E, lowest floret; F, palea of the lowest floret; G, upper floret; H, palea of upper floret; I, flower; J, caryopsis. A $\times \frac{1}{2}$, B $\times 3$, C-J $\times 6$.

2-nervosa, scabrida ad apicem bifida. Rhachilla supra glumas et inter flosculos disarticulans. Lodicae 2. Stamina 3. Antherae 3.5 mm. Caryopsis ignota. Typus. [Turkey C3 Antalya]: d. Finike, Bucht von Atbükü, Macchie, *Pinus brutia* Wald, 0–50 m, 26 v 1950, A. Huber-Morath 12485 (holo. Hb. Huber-Morath, iso. E).

This new species from SW Anatolia has a rather lax panicle and is closely related to *Gaudinopsis quercetorum* (Boiss.) M. Doğan (see p. 83). The lowest lemma is without an awn but bears a mucro (c. 1 mm) from its sinus.

In Table 3, *G. huber-morathii* and the other three species of *Gaudinopsis*, *G. macra*, *G. quercetorum* and *G. sorgerae*, are compared on the basis of floral characters.

I have named this species after its collector, Dr A. Huber-Morath (Basel), who kindly sent it to me together with other Turkish grass collections.

TABLE 3

Spikelet and floral characters distinguishing all known species of *Gaudinopsis*

	<i>macra</i>	<i>quercetorum</i>	<i>huber-morathii</i>	<i>sorgerae</i>
Spikelet (mm)	6–17	8.5–10	8–11	4.5–10
Floret number	5–7	4–5	6–7	3–8
Lower glume (mm)	4–6.5	4.5	4.5–6	3–4
Upper glume (mm)	5–7	6	6–6.5	3.7–4.8
Lowest lemma (mm)	4.5–7.5	7	5.5–6.4	4.2–5.5
Apex of lowest lemma	Acute	Acuminate	Bifid, with a terminal mucro	Acute to minutely bifid
Awn of lemma (mm)	3.5–10	8	3–6	Absent
Palea (mm)	4.5–5	4.5–5	5.5–6	3.8–4.8
Anthers (mm)	1.5–2.5	2.4–3.1	3.5	2.1–3

Gaudinopsis sorgerae M. Doğan, sp. nov. Fig. 5.

Ab omnibus ceteris speciebus generis lemmatibus haud aristatis facile distinguenda.

Herba annua. Culmi 7.5–16 cm longi, erecti, tenues, glabri et laeves, infra paniculam et ad nodos puberuli, 2–3-nodati, purpurascens. Lamina 1.2–3 cm × 0.6–1.2 mm, convoluta, utrimque in pagina superiore scabridula, in pagina inferiore demum glabra; ligula 1.5–3.5 mm longa, membranacea, acuta. Panicula 2.5–5 cm longa, 0.8–1.7 cm lata, rigida, oblongo-lanceolata, 6–15-spiculata, interrupta. Pedicellis 2–8.5 mm, dorsaliter compressi, scabridi. Spiculae 4.5–10 mm longae, lateraliter compressae, lanceolatae, flosculis 3–8. Glumae lanceolato-acutae; gluma inferior 3–4 mm longa, 3-nervosa; gluma superior 3.7–4.8 mm longa, 3(–5)-nervosa. Lemma 4.2–5.5 mm longum, lanceolatum, acutum vel ad apicem bidenticulatum, haud aristatum, dorso rotundatum, rigidum, dorsaliter inferne minutissime scabridulum; callus pilis ad 0.5 mm. Palea 3.8–4.8 mm, apice bifida, 2-nervosa, setulosa. Rhachilla supra glumas et inter flosculos disarticulans. Lodicae 2. Stamina 3. Antherae 2.1–3 mm. Ovarium glabriusculum. Stigmata 2. Caryopsis 1.7 mm longa, elliptica ex dorsaliter. Fl. Jul.

Typus. [Turkey C3 Isparta]: 17 km E of Eğridir (Anamas), *Pinus nigra* subsp. *pallasiana* Wald, 1250 m, 15 vii 1968, F. Sorger: 68-36a-12 (holo. Hb. F. Sorger).

This species is apparently a local endemic in Turkey, known only from the type gathering which was collected in SW Anatolia in 1968 by Dr F. Sorger (Vienna). At first glance it is a rather puzzling plant because awns are completely lacking. However, except for this anomaly it certainly has all the floral and vegetative characters of *Gaudinopsis*, though it is impossible to key it out to that genus in present Floras, since the keys are all concerned with the floral characters of *G. macra*, such as the presence of an awn on the lowest lemma.

In Table 3 *G. sorgerae* and the other species of *Gaudinopsis* are compared on a number of taxonomically useful floral characters.

The new species has been named after its collector, Dr F. Sorger, who kindly sent it to me for determination.

NEW COMBINATIONS

***Alopecurus utriculatus* Banks & Sol. subsp. *anthoxanthoides* (Boiss.) M. Doğan, comb. et stat. nov.**

Syn.: *Alopecurus anthoxanthoides* Boiss., Diagn. ser. 1(13):42(1853).

***Calamagrostis parsana* (Bor) M. Doğan, comb. nov.**

Syn.: *Deyeuxia parsana* Bor in Kew Bull. 3:42(1948).

***Gaudinopsis quercetorum* (Boiss. & Bal.) M. Doğan, comb. nov.**

Syn.: *Ventenata quercetorum* Boiss. & Bal. in Boiss., Diagn. ser. 2(4):130(1859).

***Helictotrichon pubescens* (Huds.) Pilger subsp. *longifolia* (Boiss.) M. Doğan, comb. et stat. nov.**

Syn.: *Avena pubescens* Huds. var. *longifolia* Boiss., Fl. Or. 5:545(1884).

***Phleum montanum* C. Koch subsp. *serrulatum* (Boiss.) M. Doğan, comb. et stat. nov.**

Syn.: *Phleum serrulatum* Boiss., Diagn. ser. 2(4):125(1859).

***Phleum paniculatum* Huds. subsp. *ciliatum* (Boiss.) M. Doğan, comb. et stat. nov.**

Syn.: *Phleum asperum* Vill. var. *ciliatum* Boiss., Fl. Or. 5:482(1884).

***Zingeria pisidica* (Boiss.) Tutin subsp. *poaeforme* (Boiss.) M. Doğan, comb. et stat. nov.**

Syn.: *Milium trichopodum* Boiss. var. *poaeforme* Boiss., Fl. Or. 5:511(1884).

***Zingeria trichopoda* (Boiss.) P. Smirn. subsp. *biebersteiniana* (Claus) M. Doğan, comb. et stat. nov.**

Syn.: *Agrostis biebersteiniana* Claus in Beitr. Pfl. Russ. Reich. 8:264(1851).

NEW RECORDS FOR TURKEY

***Aira praecox* L., Sp. Pl. 65(1753).**

A2(A) Istanbul: Çatal Da., v 1865, *René du Parquet* (BM).

***Alopecurus davisii* Bor in Notes RBG Edinb. 25:63(1963).**

B1 Izmir: Kemalpaşa, Nif Da., 1500 m, 25 v 1971, *H. Peşmen & Ö. Seçmen* (EGE 16357).

Previously only known from the type collected on the island of Samos.

Anthoxanthum aristatum Boiss., Voy. Bot. Midi. Esp. 2:638(1842).

Is. Gökçeada: near Kuzulımani, *E. Leblebici & Ö. Seçmen* 1348 (EGE).

Arrhenatherum kotschy Boiss., Diagn. ser. 1(7):122(1846).

B7 Sivas: d. Divriği, Dumluca Da., 30 v 1968, *T. Baytop* (ISTE 12878).

Trisetum sibiricum Rupr. in Beitr. Pfl. Russ. Reich. 2:65(1848).

A9 Kars: 6 km from Sarıkamış to Karakurt, 2150 m, 15 vii 1966, *P. H. Davis* 46563 (E).

ACKNOWLEDGEMENTS

I am grateful to my supervisors Prof. P. H. Davis and Dr P. M. Smith for their supervision and helpful criticism. This research programme has been supported by 'Türk Eğitim Vakfı' (Istanbul), and is financed by The Hikmet Birand Scholarship, for which I am much indebted.