Notes on Two Alien Taxa of *Rumex* L. (Polygonaceae) Naturalized in the Hawaiian Islands[1]

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During his stay at the National Museum of Natural History, Smithsonian Institution, Washington DC (US), in October 1995, the senior author studied specimens of alien taxa of the genus *Rumex* L. (Polygonaceae) collected in the Hawaiian Islands. As a result of these studies, 2 taxa new for the archipelago were discovered in the US collections, and among the BISH specimens sent on loan, one of which (*Rumex conglomeratus* Murray) was briefly reported in last year's *HBS Records* (Wagner *et al.*, 1997). Here we report an additional subspecies of *R. crispus* naturalized in the archipelago, give descriptions of both species, and provide a revised key to all of the species of *Rumex* in the Hawaiian Islands. Abbreviations in the key follow Wagner *et al.* (1990).

Rumex conglomeratus Murray, Prodr. Stirp. Goetting: 52. 1770.
Vernacular names: clustered dock, clustered green dock.

Erect perennial herbs, normally glabrous (or occasionally lower surface of leaves indistinctly papillose along veins); stems 3–8(-12) dm long, branched in the upper 2/3 (sometimes branched with several stems from the base). Basal and lower cauline leaves oblong-lanceolate, obovate-lanceolate, or lanceolate, normally (5-)10–30 long, 2.0–6.0 cm wide; base broadly cuneate, rounded or truncate (rarely subcordate); apex subacute (occasionally obtuse); margin entire to weakly undulate. Inflorescences terminal, lax, interrupted, broadly paniculate, occupying the upper 2/3 of the stem; branches of inflorescence simple or nearly so; almost all but uppermost verticils with subtending leaves (panicle leafy at least in lower 2/3 of its length). Flowers usually perfect, ca. 10–20 in dense remote verticils. Pedicels slender, short (ca. 1–4(-5) mm long, i.e. about as long as valves, or slightly longer), articulated in the proximal 1/3 or occasionally near the middle; articulation distinctly swollen. Valves (inner tepals) at maturity oblong-lanceolate, oblong, lingulate, ca. twice as long as wide, 2–3 mm long, usually 1–1.6 mm wide; base cuneate or truncate, apex obtuse; margins entire; tubercles 3, equal or subequal in size. Nuts (achenes) dark reddish-brown, ca. 1.5–1.8 mm long, 1.0–1.4 mm broad. 2 n = 20 (Jaretzky, 1928; A. Love, 1986).

This species is native to Europe, western and southwestern Asia and northernmost Africa (Rechinger, 1958, 1964). It is also widely naturalized in many regions of the world. For example, it is comparatively widely distributed and completely naturalized in North America, mostly in the eastern part of the United States and along the Pacific Coast from southern British Columbia (Canada) to Mexico (for more details see Rechinger, 1937; Dawson, 1979). Judging from available herbarium specimens (consulted in GH, MO, NY, and US), it seems to be quite common in California, coastal regions of Oregon and Washington.

Rumex conglomeratus, together with the closely related *R. sanguineus* L., belongs to *Rumex* subgen. *Rumex* sect. *Rumex* subsect. *Conglomerati* Rech. f. (Rechinger, 1937). This subsection is very close to subsect. *Obtusifolii* Rech. f. (Rechinger, 1937). Hybrids *R. conglomeratus* × *R. obtusifolius* L. (*R.* × *dufftii* Hausskn.) and *R. conglomeratus* × *R. crispus* L. (*R.* × *sagorskii* Hausskn.) are known from Europe and could be expected in the

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Hawaiian Islands where the naturalized ranges overlap. *Rumex conglomeratus* is often confused with immature specimens of *R. obtusifolius*, since young valves of the latter usually have very indistinct teeth, and their shape is similar to that of *R. conglomeratus*. Due to that occasional confusion, distribution of *R. conglomeratus* in North America is in need of additional study; some of the literature records for it may in fact refer to young specimens of the more common species, *R. obtusifolius*.

Within its native range in Eurasia *Rumex obtusifolius* is differentiated into several subspecies: the predominantly western *R. obtusifolius* subsp. *obtusifolius*, the eastern subsp. *sylvestris* (Wallr.) Rech. f., an intermediate central European subsp. *transiens* (Simonkai) Rech. f., and a montane subsp. *subalpinus* (Schur) Simonk. (for more details see Cavers & Harper, 1964; Lousley & Kent, 1981; Rechinger, 1958, 1964). As correctly noted in Wagner *et al.* (1990), only the typical subspecies is known from the archipelago so far. However, the second subspecies is occasionally known as introduced in North America, and could be found in Hawai‘i in the future.

Material examined. **KAUA‘I**: Koke‘e State Park, Mohihi Rd. near Camp Sloggett, disturbed roadside; ca. 1100 m, 26 May 1984, *W. L. Wagner et al. 5370* (US [2]).

Rumex crispus L. subsp. ***fauriei*** (Rech. f.) Mosyakin et W. L. Wagner, **comb**. **et stat. nov**. *Rumex fauriei* Rech. f., in Feddes Repert. Sp. Nov. 33: 358. 1934. Type: Insula Sachalien, circa Korsakof, 28 August 1908, *Faurie 652* (holotype, G; isotypes, W, LE!).

Rumex crispus (vernacular names: curly dock, yellow dock) is notorious for its extremely wide morphological variability, high ecological plasticity, and almost cosmopolitan distribution. Originally native probably only to temperate Eurasia, now this species occurs almost everywhere in the world. Not surprisingly, numerous infraspecific taxa and segregate species were described within *R. crispus* s. l. Many of these taxa appear to represent minor or populational variation of no taxonomic significance. These variants are apparently not confined to any particular geographical area. However, there are other patterns within the overall variation within the *R. crispus* complex that are geographical and/or ecological races, and these deserve recognition at the subspecies level. For example, in the second edition of *Flora Europaea*, 3 subspecies were recognized within *R. crispus* (Stace, 1989; Rechinger, 1993). In Asian material of *R. crispus* s. l., Rechinger (1949) recognized 6 varieties; however, he did not cite any specimens of *R. crispus* from Japan, but noted that the Japanese plants with smaller, more acute valves, longer pedicels, and smaller achenes most probably belongs to *R. fauriei* Rech. f. *Rumex fauriei* was described from the southernmost part of Sakhalin Island, near Korsakov as a species closely related to *R. crispus*. As discussed below, we here treat this entity as a subspecies of *R. crispus*. According to Rechinger (1949), the diagnostic characters for distinguishing these 2 taxa are: 1) *R. crispus*: “Valvae 3.5–5(-6.5) mm longae et latae, valde variabiles, rotundato- vel oblongo-cordatae, plerumque obtusae rarius acutiusculae. Nux (2-)2.5–3(-3.5) mm longa. Pedicelli perigonio ca. duplo longiores” 2) *R. fauriei*: “Valvae 3–3.5(-4) × 2–3 mm, ovato-vel subcordato-triangulares acutae. Nux 2.5 mm longa. Pedicelli tenuissimi perigonio 2–3-plo longiores”. The only specimens of *R. fauriei* cited by Rechinger in the 2 mentioned publications were the type collection and additional collection from the Kurils (“Shikotan, *Ohwi 1139*, in herb. Ups.”). No particular localities of this taxon were cited for Japan or China. Apparently because of this *R. fauriei* has been generally ignored in the Japanese and Chinese floras and manuals, or, at best, cited as a synonym of *R. crispus* or *R. japonicus* Houtt. [= *R. crispus* var. *japonicus* (Houtt.) Makino; *R. crispus* subsp. *japon-*

icus (Houtt.) Kitamura]. However, *R. japonicus* is a species more closely related to *R. stenophyllus* Ledeb. than to *R. crispus*, and can be distinguished from the latter in having fruiting valves minutely but distinctly dentate in the upper half, as well as by its broader leaves with cordate or abruptly truncate base. There is no doubt that native specimens identical with *R. fauriei* are known from Japan, as well as from eastern China.

In Russian botanical literature the status of *R. fauriei* was also rather uncertain. Voroshilov (1966) accepted *R. fauriei* as a distinct species and, following Rechinger's description, distinguished it from *R. crispus* by its "valves ovate or narrowly triangular-ovate, subacute at apex; pedicels 2–3 times as long as valves" (Voroshilov, 1966: 159), when the typical *R. crispus* has "valves ovate-orbicular or broadly ovate, obtuse or subacute at apex; pedicels less than 2 times as long as valves". Subsequently (Voroshilov, 1982), he changed his opinion and reduced *R. fauriei* to synonymy of *R. crispus*. However, he noted that "plants from Sakhalin and Kuril Islands differ from the western plants [. . .] in having smaller fruiting valves 3–3.5 mm long, slightly erose at margins". The last character (erose margins of valves) is not peculiar to *R. fauriei* s. str. The species rank for *R. fauriei* in the Russian Far East was restored by Tzvelev (1987, 1989), who also reported it for the "Sino-Japanese region", evidently after consulting some East Asian specimens deposited at LE. In the key and descriptions, Tzvelev has somewhat modified diagnostic characters of *R. fauriei*, and noted its narrower leaves (as compared to those of *R. crispus* s. str.), as well as tubercle being developed usually only at 1 of the 3 fruiting valves (this character is peculiar also for *R. crispus* var. *unicallosus*).

In our opinion, the size of valves and achenes in *R. crispus* subsp. *fauriei* is not the most essential character that distinguishes it from *R. crispus* subsp. *crispus*. For example, the cultivated Hawaiian specimen (*Staples & Kadowaki 892*, BISH) and also some Japanese and eastern Chinese plants have valves ca. (3.7-)4(-4.5) mm long, more or less subacute to almost obtuse at apex. However, many native East Asian specimens of the *R. crispus* aggregate share such distinctive combinations of characters as comparatively long pedicels, lax inflorescences with remote whorls, leaves almost flat, or at least not so undulate at margins as in *R. crispus* s. str. In addition, all leaves are narrow, usually narrowly lanceolate, lanceolate-linear or even linear (especially in the inflorescence). This morphotype is strikingly different in habit from the typical European *R. crispus*, as well as from most of its ecological forms found among weedy cosmopolitan strains of the species. Individual characters of *R. crispus* s. str. and *R. fauriei* often intergrade into each other, and intermediate forms do occur in the regions where these taxa are sympatric. Because of that, we believe that species status for *R. fauriei* is hardly appropriate. At the same time, it definitely represents a morphotype (geographical race) confined to the clearly outlined geographical area in Far East, and it is therefore appropriate to treat it as a subspecies. Since it is hardly possible now to find any species of *Rumex* that is not sympatric, at least partly, with the synanthropic *R. crispus* s. str. (most probably introduced in the Far East), the intermediate forms connecting subsp. *crispus* and subsp. *fauriei* possibly developed as a result of hybridization between these taxa.

Apparently, *R. crispus* subsp. *fauriei* was introduced to Hawai'i from East Asia—either intentionally, being brought as a medicinal plant by Japanese or Chinese immigrants, or accidentally, in ship ballast, with agricultural products, seeds of cultivated plants, etc. Its present status in the Hawaiian flora is rather uncertain and needs additional study.

Material examined. **LĀNA'I**: Kaiholena, 17 Mar 1914, *G. C. Munro 284, 309* (BISH); Lalakoa, 1700 ft. 13 Jan 1930, *G. C. Munro 502* (BISH). **O'AHU**: Honolulu, Mānoa Valley, grounds of H.L. Lyon Arboretum, 3860 Mānoa Rd., cultivated in Herb Garden, said to be used medicinally by Chinese, 6 May 1993, *G. Staples & A. Kadowaki 892* (BISH).

Most of the specimens of *R. crispus* collected in the Hawaiian Islands deposited at BISH belong to the typical *R. crispus* subsp. *crispus*. However, 2 additional noteworthy specimens are discussed here.

The first specimen is represented by a small portion of fruiting inflorescence, 1 deformed basal (or lower cauline) leaf, and small young rosette with a portion of caudex. Judging from the size of fruiting valves (ca. 4.0–5.5 mm long and broad), the plant could be *R. patientia* L. However, the material is insufficient for exact identification, since specimens with comparatively large valves occasionally occur among southern forms of *R. crispus* as well.

Material examined. **LĀNA'I**: Dole Pineapple Plantation, weed in new land to be planted with pineapples in 1964, 14 Aug., *J. W. Smith, Jr. s.n.* (BISH).

The second specimen evidently belongs to *R. crispus*, but has unusually large, unequal subglobose or ovate tubercles with minutely punctate surface. The largest tubercles in most of flowers reach ca. 2.2–2.6 mm long, and are almost as broad as valves. Very large tubercles often occur in littoral (coastal) or alluvial (riparian) taxa of *Rumex*. This character may be regarded as an adaptation to hydrochory (i.e. dispersal of diaspores by water). Large tubercles, often subequal to fruiting valves, are typical for coastal docks belonging to different infrageneric taxa. For example, in the section *Axillares* Rech. f. subsect. *Salicifolii* Rech. f., very large tubercles are found in *R. pallidus* Bigel. (coastal marshes and dunes, sandy and rocky beaches from Newfoundland to Massachusetts), *R. crassus* Rech. f. (Pacific coast in California and Oregon), *R. transitorius* Rech. f. (along the Pacific coast from northern half of California to southern Alaska). Parallel forms with large tubercles are known also in the section *Rumex* subsect. *Maritimi* Rech. f.: *Rumex persicarioides* L. (coastal regions from Quebec to New York), and *R. ochotskius* Rech. f. (Far East from northern Japan to the Okhotsk Sea region, especially Sakhalin and Kuril Islands). Infraspecific taxa of *R. crispus* with large tubercles, namely subsp. *littoreus* (Hardy) Akeroyd and subsp. *uliginosus* (Le Gall) Akeroyd are known in the coastal regions of western Europe (see Lousley & Kent, 1981; Stace, 1989; Rechinger (revised by Akeroyd), 1993). The Hawaiian plant is very similar in its characters to the *R. crispus* subsp. *littoreus* and indeed may be a collection of it introduced to the archipelago.

Specimen examined. **O'AHU**: Honolulu, Liliha Street, garden of Annie Ho (plant used to cure sprains), Jun 1932, *Amy Suehiro s.n.* (BISH).

KEY TO SPECIES OF *RUMEX* IN THE HAWAIIAN ISLANDS

1. Shrubs, subshrubs, or scandent shrubs (lianas), usually woody at least near the base; stems normally with regular, leafy axillary shoots that tend to develop secondary axillary inflorescences (often overtopping primary ones) [*Rumex* subgen. *Rumex* sect. *Axillares* Rech. f.] (2).
1. Perennial herbs; stems mostly erect, solitary or several from the base, not branching below terminal paniculate inflorescence, usually without axillary shoots (4).
2(1). Leaves usually undulate, bases of lower leaves cordate (sometimes on Nihoa upper leaves with bases broadly cuneate); the 2 sides of a single arm of a mature nut subparallel, the angle very narrowly acute; margins of arms of mature nuts without a conspicuous rim; plants usually at least sparsely pubescent, sometimes glabrous; N, K, O .... *R. albescens* Hillebrand
2. Leaves flat or only slightly undulate, bases of lower leaves broadly cuneate to truncate

(sometimes on Maui and Moloka‘i subcordate); the 2 sides of a single arm of a mature nut distinctly diverging, the angle ca. 45°; margins of arms of mature nuts with a conspicuous rim; plants glabrous or occasionally (Hawai‘i) pubescent in the inflorescence (3).

3(2). Erect shrubs, stems 7–10 dm long; leaves thick and somewhat glossy; inflorescences green or yellowish green, relatively narrow and erect; on lava flows, H ..... *R. skottsbergii* Degener & I. Degener

3. Scandent shrubs or lianas, stems (8-)20–200 dm long; leaves not especially thick (or sometimes relatively thick in open areas and at high elevations on East Maui and Mauna Kea, Hawai‘i), dull; inflorescences red or rarely green and sometimes tinged red, open and spreading, usually pendent (or often erect in high elevation populations on Maui and Mauna Kea, Hawai‘i); usually in woodland or forest, Mo, M, H ..... *R. giganteus* W. T. Aiton

4(1). Plants dioecious (rarely polygamo-monoecious); flowers unisexual. Basal and lower cauline leaves normally hastate at base, with spreading acute lobes. Pedicel with evident articulation near the base of perianth segments. Inner perianth segments (valves) not enlarged at maturity, or rarely with barely visible free wing not more than 0.1–0.2 mm broader than achene; margins entire; tubercles absent. [*Rumex* subgen. *Acetosella* (Meisn.) Rech. f.] ..... *Rumex acetosella* L.

4. Plants monoecious [extremely rarely dioecious specimens occur in some species]; flowers normally bisexual, or sometimes bisexual and unisexual within the same inflorescence. Leaves usually not hastate or sagittate. Pedicel normally articulated near the middle, or in the basal half. Valves clearly enlarged at maturity, evidently broader and longer than achene; margins entire or variously dentate; tubercles present or absent (5).

5(4). Valves triangular, with 3–5 distinctly hooked teeth on each side; apex also hooked; tubercles absent, or mid-vein indistinctly swollen. *Rumex* subgen. *Rumex* sect. *Rumex* subsect. *Acrancistron* Rech. f. ..... *Rumex brownii* Campd.

5. Valves variable, margins entire, indistinctly erose, or dentate, but never with hooked teeth and apex; tubercles usually present (6).

6(5). Valves dentate at margins; teeth triangular-subulate, normally at least 0.3 mm long, or longer, often evident even in flowers. *Rumex* subgen. *Rumex* sect. *Rumex* subsect. *Obtusifolii* Rech. f. ..... *Rumex obtusifolius* L.

6. Valves entire at margins, or rarely minutely and indistinctly erose (7).

7(6). Valves oblong-lanceolate, oblong, lingulate (tongue-shaped), ca. twice as long as wide, entire at margin. [*Rumex* subgen. *Rumex* sect. *Rumex* subsect. *Conglomerati* Rech. f.] ..... *Rumex conglomeratus* Murray

7. Valves suborbicular, ovate, or ovate-triangular, ca. as long as wide (or at least always distinctly less than twice as long as wide), entire or indistinctly erose at margin. [*Rumex* subgen. *Rumex* sect. *Rumex* subsect. *Crispi* Rech. f.] ..... *Rumex crispus* L.

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