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Revision of Cardamine and Related Cruciferae in Hawaii, and Nasturtium in Polynesia Pacific Plant Studies 3[1]

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INTRODUCTION

The small, white-flowered cress, *Cardamine hirsuta* Linnaeus was early recorded as an adventive in Hawaii. It was collected in 1840-41 by the Wilkes Expedition and listed by Asa Gray in his volume on the botany of the expedition (Bot. U. S. Explor. Exped. **15**(1): 50, 1854). He indicated that there were two kinds, saying "One of the specimens agrees with the ordinary *C. hirsuta.* The other has rounder, obtusely lobed, somewhat reniform, and more petioled segments of the leaves; and resembles the var. *sylvatica* (*C. sylvatica,* Link)." *C. sylvatica* Link is now treated as a synonym of *C. flexuosa* Withering. *C. sarmentosa* was cited in Gray's volume, but only from the Samoan and Society Islands.

Mann and Brigham collected *C. hirsuta* in 1864-65, and Horace Mann, Jr. included it in his published Enumeration. Mann's description included in his subsequent flora seems largely compiled, as it does not apply well to his specimen, *Mann and Brigham 311* from woods, Kona, island of Hawaii (Am. Acad. Arts Sci., Proc. **7**: 149, 1867).

William Hillebrand describes *C. hirsuta* (Fl. Hawaiian Ids., 12, 1888) and records it as a common weed in the gardens. This small, weedy plant is indigenous to temperate Eurasia, and has spread

[1] This is the third in a series of papers designed to present descriptions, revisions, and records of Pacific island plants. The preceding papers were published as B. P. Bishop Mus. Occ. Papers **17**(7), 1942; **17**(13), 1943.

widely in Africa and North America. It has persisted in Hawaii since its early introduction but, like many weeds, has already run its course and is now rare and local. A specimen has recently come to the Bishop Museum from an unnamed student who collected it in 1933 near the Volcano House, Kilauea, island of Hawaii.

Hillebrand in his flora (p. 12) lists and describes *Cardamine hirsuta* Linnaeus but in his discussion he briefly characterizes two other atypic kinds. For the first of these he states, "From the woods of Kona! Hawaii (about 3000 ft. above sea level), we have spreading plants, 1½ ft. and more in length, with erect and flagelliform branches (as in *C. sarmentosa*), the latter dividing again into ascending branchlets; all leaflets generally cordate, the terminal one 1′ [= one inch] in diam.; pedicels and pods of the elongate open raceme spreading as in *C. sylvatica,* Lk." For the second he says, "In plants again from *Haleakala,* Maui (6000 ft. above the sea), the stem is quite leafy, the leaflets even of the lower leaves are all cuneate at the base while those of the middle and upper leaves are oblong and decurrent."

The above are the earlier treatments of the Hawaiian cresses of this group. Subsequent literature on the adventive plants in Hawaii has omitted them, but several authors have proposed new species or varieties of the group as new endemics. A revision of both native and introduced kinds is here presented. The water cress, *Nasturtium officinale* R. Brown is cultivated and also partially established in the territory. It is well known, hence, it is omitted from following treatment.

Key

Pods divergent, terete; plants glabrous; leaflets mostly reniform, the terminal one 10-30 mm. wide; perennial from warty, fleshy tubers and slender rhizomes ..... **1. Nasturtium sarmentosum.**

Pods ascending, flattened parallel to the partition; leaflets mostly from oval to linear, the terminal one 1-15 mm. wide; annuals with fibrous roots.

Leaflets hirsute above,

Cauline leaves with narrowly oblanceolate leaflets.... **2. Cardamine hirsuta.**

Cauline leaves with oval to suborbicular leaflets..... **4. Cardamine flexuosa f. umbrosa.**

Leaflets glabrous,

Lateral leaflets broadly oval in outline but with 3-5 coarse, rounded lobes..... **3. Cardamine konaensis.**

Lateral leaflets oblanceolate with 2-4 coarse serrations or crenations..... **5. Cardamine flexuosa var. haleakalensis.**

ENUMERATION

1. **Nasturtium sarmentosum** (Forster filius) O. E. Schulz, Engler's Bot. Jahrb. **32**: 595, 1903.

   Cardamine sarmentosa Solander ex Forster filius, Flor. Ins. Austral. Prodr. Appendix 91, 1786, nomen.; Forster filius ex A. P. DeCandolle, Reg. Veg. Syst. Nat. **2**: 265-266, 1821.

   Cardamine hirsuta Linnaeus sensu Hillebrand, Fl. Hawaiian Ids., 12, 1888 as to second variant, not the others, not sensu Linnaeus.

   ? *Rorippa Elstonii* Hochreutiner, Candollea **2**: 368-370, 1925, from description only, type not seen.

Hawaiian Islands

Kauai: Hanakapiai, Maunapuluo, Napali Coast, under guava tree, Dec. 30, 1930, *H. St. John et al. 10868.*

Oahu: Palama, open pastures, at sea level, Dec. 10, 1923, *G. P. Wilder 73;* Mokuleia, slopes of Kaala, on water fall, May 1, 1912, *C. N. Forbes 1804.O;* Puu Kaua, Waianae Mts., South Fork of Ekahanui Gulch, Honouliuli, 1,600 ft. alt., thicket by trail, Feb. 27, 1938, *H. St. John 18686.*

Maui: Nuanualoa, Dec. 5, 1919, *C. N. Forbes 1758.M.*

Hawaii Island: Kealakomo, Hawaii National Park, alt. 500 ft., in lava tube opening, Feb. 18, 1943, *G. O. Fagerlund and A. L. Mitchell 375.*

Locality uncertain: specimen without data, except medical uses and Hawaiian name.

N. sarmentosum is well known and well described in the literature on the botany of Polynesia and Oceania, so no description is needed here. Its place in native medicine does need emphasis, however. Much of the medicinal botany of the Hawaiians has been lost, but portions of it have been recorded. In the Bishop Museum there are two Hawaiian specimens with medical data. On one, without other data, the colloquial Hawaiian name is given as *mahimahi* and its use as to "mash and tie on head." The label on the specimen from Oahu (*Wilder 73*) doubtfully gives the native name as *ihi* and gives the use as "with other herbs as medicine." The Hawaiian name *ihi* is applied to various native species of *Portulaca* and to the adventive species of *Oxalis.* There is no mention of *N. sarmentosum* as a

medicinal plant in the papers by D. M. Kaaiakamanu or N. P. Larsen, or in any of the taxonomic papers. The only published record is in an ethnological paper by E. S. C. Handy, M. K. Pukui, and K. Livermore, who give the colloquial name as *paihi* and the medicinal use as that of a consumption cure (B. P. Bishop Mus., Bull. **126**: 21, 47, 1934). Mrs. Pukui furnished the specimen and the ethnobotanical information, and Marie C. Neal determined the specimen as *Cardamine hirsuta* or *C. sarmentosa*. This was the first suggestion that *C. sarmentosa*, which is now called *Nasturtium sarmentosum*, was in Hawaii and was one of the Hawaiian therapeutic plants. Mrs. Pukui reports to the writer that she was taught to know the plant, its name, and its medicinal use by her mother, Paahana Wiggin, who learned her medicinal botany from her father, a *kahuna lapa'au*, or Hawaiian herb doctor. Hence, the plant is certainly not a recent arrival in Hawaii.

Nasturtium sarmentosum is widespread in Oceania, especially in Polynesia. It was first described from a specimen collected on the "insulâ Teauteâ" by the Forsters, during the second voyage of Captain James Cook. A good photograph from the British Museum shows this locality clearly written on the type specimen as "Teoutea." After a prolonged investigation this has been identified with Tiookea, of the text and map of the narrative of Captain Cook's Second Voyage, which is now called Takaroa, Tuamotu Archipelago. Forster listed three other plants as collected on Teautea: *Lithospermum incanum* [doubtful species, probably *Heliotropium anomalum* Hooker and Arnott], *Lythrum Pemphis* [= *Pemphis acidula* Forster], and *Lepidium piscidium* [= *L. bidentatum* Montin], all plants characteristic of the low coral islands. *Nasturtium* has not been collected subsequently on the low Tuamotus, though it has been collected on two other low coral islands, Tokelau and Funafuti. However, the original locality is not questioned. The plant is found in the Tuamotus on Makatea and, though not definitely so stated by Wilder, it is implied that it is near the native village of Maumu, which is on a coastal flat below the cliffs. It also occurs in the Gambier Islands,[2] and on various of the high islands it is found at the top of the beach and in rocky soil near the coastal villages. To give an idea of its occurrence, names, and uses, the following summary has been prepared.

[2] Mangarevan Islands. The French name is used at the request of the author.—Editor.

NASTURTIUM SARMENTOSUM (FORSTER FILIUS) O. E. SCHULZ

LOCALITY	NATIVE NAME	USE
Solomon Islands		
San Cristoval Island		
New Caledonia	djanunao	eaten as antiscorbutic
Isle of Pines		
Loyalty Islands		
New Hebrides		
Espiritu Santo		
Ellice Islands		
Funafuti	lou	juice from masticated leaves strained, poured into ear for earache
Norfolk Island		
Rotuma Island	raumatori	
Fiji Islands		
Tongan Islands		
Tokelau (Union) Islands		
Niue (Savage) Island	holofa	
Samoan Islands		
Savaii	eski	
Tutuila	lautaliga	
Tau		
Olosega		
Cook Islands		
Rarotonga	toatoa	medicinal
Society Islands		
Raiatea	moa hau ino	
Tahiti	patoa (potoa); pataa purahi	eaten fresh as greens
Meetia		
Austral Islands		
Rurutu	tatahihara	cathartic when cooked with coconut milk
Tubuai	patoa	medicines for internal disorder; for boils; for stiffness or neuralgia
Raivavae		
Rapa	puatotara (puatortara)	food; medicine
Tuamotu Archipelago		
Makatea	patoa purarahi	
Takaroa		
Gambier Islands		
Mangareva	torotogoiti	
Akamaru		
Kamaka		
Pitcairn		
Marquesas Islands	aumoriaumori	
Nukuhiva	mani; mahi; mahimahi	juice of crushed leaves as *fanua* to drive away evil spirits after childbirth

Locality	Native Name	Use
Hivaoa		
Hawaiian Islands	mahimahi	medicinal, as mash to tie on head; for consumption
Kauai		
Oahu	paihi (ihi?)	
Maui		
Hawaii		
Easter Island	kaiore hiva; kaiore teatea	
Peru		
Lima (introduced)		

The writer is familiar with the occurrence of *N. sarmentosum*, having collected it on more than a dozen Polynesian islands besides the Hawaiian Islands. Many authors have noted it near villages and in cultivated land and have recorded it as a weed. H. B. Guppy included it in his list of aboriginal weeds found in Oceania by the botanists of the Captain Cook expeditions, 1768-1780 (Observ. Naturalist in Pacific **2**: 604, 1906). He lists it for Tahiti, which the collector Forster did not mention. Perhaps Guppy inferred that Teautea Island was a part of Tahiti.

The writer found *N. sarmentosum* cultivated by the natives in the gardens at Rikitea, Mangareva. Though with fine, fibrous secondary roots, it is a perennial, having swollen, warty tubers and horizontal rhizomes which form connected colonies. It is commonly found also in the environs of the villages; in rocks, either coral or volcanic just above the beach; by the edge of the gardens; in tall grass or in thickets near the village. Also it does very well in rocky talus, if moist, on steep mountain slopes, and is to be found occasionally up to 1,000 feet and at one locality up to 2,100 feet altitude. It shows no significant variations, appearing to be the identical species on all these remote islands. Except for the halophytes and littoral species, very few vascular plants are indigenous over such a vast area in Oceania. If a plant stock has colonized all Polynesia, speciation has usually resulted and local endemics are to be found on many of the island groups.

No effort has been spared in the attempt to translate the colloquial names given to the plant by the native inhabitants of the various Melanesian and Polynesian Islands. For many plants, especially the economic ones, it is immediately evident that the same colloquial name has been carried the full width of the Pacific and has persisted in slight dialectic modifications on all the islands. To the contrary, the

Nasturtium is usually given a distinct name in each island or island group. The plant is a perennial with shallow rhizomes, with leaves and stems in tufts or bunches, and the leaflets auriculate in shape, fleshy, cool to the touch, but hot and peppery to the taste. Some of these characteristics are alluded to in the native names, which are thus descriptive; and two of the names alluded to its being foreign or imported. Only about half of the names could be translated by staff members of the Bishop Museum or by use of the available dictionaries. Names of native plants are poorly represented in these dictionaries, whereas biblical plants, as cedar of Lebanon or Lily-of-the-field, are represented by names which were often improvised. This emphasis on theological matters is natural, for most of the dictionaries were a product of some missionary enterprise. The compilers had but little interest in the native plants and asked few questions as to their names. Hence, it is easy to understand how many local plant names escaped attention. Below are tabulated the islands, plant names, and translations.

NASTURTIUM SARMENTOSUM

ISLAND	NATIVE NAME	TRANSLATION
Funafuti	lou	leaf
Rotuma	raumatori	leaf like pricked-up ears
Tutuila	lautaliga	leaf like lobe of ear
Rarotonga	toatoa	of a cold nature
Raiatea	moa hau 'ino	when cooked smelling bad
Rapa	puatotara	flower of porcupine fish; or prickly flower
Makatea	patoa pararahi	the patoa in large clusters
Mangareva	toro togoiti	foreign creeper; chiefly creeper
Easter	kaiore hiva	the foreign (or Marquesan from Hivaoa) thing eaten raw; or foreign famine food
	kaiore teatea	the white thing eaten raw

Though the Tahitian language is well known, no record of or meaning for *patoa* has been found. The Samoan name, *eski,* was recorded in 1929 by a field botanist and the name was clearly and legibly printed in his field number book, but there seems to have been some confusion or error. A two-syllable word with a consonant at the end of the first syllable and another consonant at the beginning of the second syllable is an impossibility in the Samoan language. Doubtless there was a vowel between the consonants, but no such word occurs in Samoan dictionaries either with or without a vowel.

The Rapan name, *puatotara* alludes to a fish, and the Marquesan and Hawaiian name is that of one of the most important large food fishes, the *mahimahi*. The Hawaiians, like other Polynesians, distinguished three regions: the sea, the shore, and the mountains. An important organism living in one region was represented by other organisms in the other two regions. For instance, the *kala* ceremony of the Hawaiians was performed by a *kahuna* (priest) to free a person from an evil spell or influence. Their word *kala* means to free. In the sea was the *limu kala*, a brown kelp (*Sargassum echinocarpus* J. Agardh or other species); on the shore was the *puakala*, a wild spiny poppy with beautiful white flowers (*Argemone alba* Lestiboudois var. *glauca* Prain); and on the mountains was the *akala*, or Hawaiian raspberry (*Rubus hawaiensis* Gray). One of these was used in the rites of the *kala* ceremony; if the *limu kala* was not available, the *puakala* or the *akala* could take its place. The related organisms from the three regions might or might not bear similar names such as those cited in the example. In any important ceremony, the main offering was the *pua'a*, or pig. In the sea was the *pua'a kai* (or pig of the sea) represented by any of the three fishes, mullet, *kumu*, or *aʻawa*. On the shore was the pig or, in lack of a pig, the *kumu* variety of taro (*Colocasia esculenta* var. *antiquorum*) or, for that matter, the leaves of any taro cooked as *luau* (greens) and then called *pua'a hulu ole* (hairless pig). In the mountains were three corresponding plants, any one of which would serve, the *ama'u* (*Sadleria Hillebrandii* W. J. Robinson), the *kukui* (*Aleurites moluccana* Willdenow), or the *olomea* (*Perottetia sandwicensis* Gray). If these were not available, the humble grass *kukaepua'a* (meaning pig droppings) (*Digitaria violascens* Link) could be used as a last resort. Thus, it is not only significant that *mahimahi* was a name of *Nasturtium sarmentosum* in both the Marquesas and the Hawaiian Islands, but it is apparent that besides its place as a food and a medicine, the plant had a place in sympathetic magic.

Botanists and ethnologists have both been remiss in learning and recording the native names and uses of the economic plants of Polynesia, but enough names are known to indicate this plant as an edible and medicinal plant of the Polynesians. We interpret it as one carried by the Polynesians when colonizing new islands and planted there and grown as an economic resource. This deliberate introduction of the plant by the Polynesian peoples on account of its medicinal uses

has already been suggested by K. Rechinger (K. Akad. Wien Math.-Naturwissensch., Denkschr. **85**: 286, or in reprint 112, 1910). It has numerous native names, but several are duplicated or occur in dialectic modifications on several remote island groups. Perhaps its insignificant size accounts for the unusually large number of unrelated colloquial names on the various Polynesian islands, and also explains why it was completely missed by many collectors or, if seen, not recognized as an economic and cultivated plant. This humble little cress was overlooked in Hawaii by all the early botanists and ethnologists. Only in the last two decades have we had its Hawaiian names and medicinal uses recorded, and it is here positively listed for the Hawaiian flora for the first time.

In conclusion, *Nasturtium sarmentosum* is considered an economic, medicinal plant of the Polynesians who doubtless introduced it to each of their new island homes, as they did with other food and economic plants, as *Artocarpus incisa, Colocasia esculenta* var. *antiquorum, Syzigium malaccensis, Cocos nucifera, Musa sapientum, Curcuma longa, Lagenaria siceraria, Tacca pinnatifida, Saccharum officinarum, Aleurites moluccana, Dioscorea alata, Morinda citrifolia, Piper methysticum, Tephrosia purpurea,* etc. Just where *Nasturtium sarmentosum* was first native is not easily determined. From the direction of migration of the Polynesians and the source of most of their other economic plants, it is probable that the plant was carried from west to east. Its native land may well have been New Caledonia or the adjacent islands.

It has been suggested that *Morinda citrifolia* attained its wide distribution by flotation. H. B. Guppy reported that the pyrenes, after being freed from the soft and quickly rotting fruit pulp, are buoyant and float as long as 53 days. He observed the pyrenes in river drift, and listed the species as littoral and of sea transport. H. N. Ridley repeats these observations and credits its wide dispersal from Ceylon to Polynesia to natural sea transport and to carriage by bats and birds (Dispersal of Plants, 295-296, 1930). The transport by bats or birds in their digestive tracts could only be for short distances. Dispersal of the seeds floating in the ocean could scarcely account for jumps of thousands of miles, as from the Society Islands or the Marquesas to the Hawaiian Islands. O. Degener (Pl. Hawaii Natl. Park, 11, 1930) states that the *Morinda* was no doubt carried to Hawaii by ocean currents, but on page 284 of the same book he states that its

distribution was probably due to both flotation and transport by Polynesians. There is every indication that this *Morinda* was an economic plant carried by the peoples on their long migrations. It does not grow in Polynesia or Melanesia as a strand plant and is not found at the edge of the beach or in saline soils. E. D. Merrill has included *Morinda citrifolia* in a list of strand plants, widespread but not cultivated in Polynesia (Sixth Pacific Sci. Congr. Berkeley **4**: 632, 1940). The writer's extensive field work in Polynesia is sufficient basis for a denial that it is a strand plant. It is on nearly all high islands and on many low coral islands, either in native cultivation or persisting after or spreading from such cultivation. Since the plant was universally used by all Polynesians who depended on the fruit for food and drink, on the stem, leaves, and fruits for numerous medicines, and on the root and stem for dyes, it is demonstrably an economic and a cultivated plant. It seems evident that its wide dispersal was due to deliberate human carriage.

There are some nomenclatorial technicalities concerning the scientific name of the little cress. It was first named *Cardamine sarmentosa* Forster filius (Flor. Ins. Austral. Prodr., Appendix 91, 1786) by the son, J. G. A. Forster who, by means of the letter S, attributed the name to Solander. However, the binomial was a mere *nomen nudum*, and has no standing in nomenclature. The name was adopted and published as *Cardamine sarmentosa* Forster in A. P. DeCandolle (Reg. Veg. Syst. Nat. **2**: 265-266, 1821). He did not credit it to Solander, or to Banks, though he cited specimens from the Banks herbarium and the Lambert herbarium. Three years later DeCandolle again included the species, crediting it to Forster (the son) (Prodr. **1**: 153, 1824). There seems no justification for crediting the species to Solander or Banks, as has frequently been done. According to our modern classification, the plant with its white flowers, terete, linear pods, and the valves with several veins, is allocated to *Nasturtium*, rather than to *Cardamine*, which has flattened pods. Most writers credit the combination *Nasturtium sarmentosum* to the authorities (Forster filius) Schinz and Guillaumin (Sarasin, F., and Roux, J. Nova Caledonia, Bot. B. **1**: 146, 1920). They did make this combination, but were not the first to do so. The earliest combination under the genus *Nasturtium* detected by the writer was by O. E. Schulz in 1903, the one here accepted. However, a majority of the botanical writers have accepted the combination made in 1920 by Schinz and

Guillaumin. There is an issue here which needs clarification. The combination by O. E. Schulz is not included in the Index Kewensis, whereas the later one by Schinz and Guillaumin is included. This omission of the earlier one would explain why many botanists have not used it, but not why Schinz and Guillaumin and certain other workers reject O. E. Schulz's combination as invalid. His method of publication was the same as that of Hooker and Arnott in making the combination *Canavalia galeata* (Gaudichaud) Hooker and Arnott. Another comparable publication of a binomial is that of *Cleistanthus collinus* (Roxburg) Bentham and Hooker (Gen. Pl. **3**: 268, 1883). They wrote, "sequentia Cleistanthus videtur:- *Cluytia collina* Roxb." That is, in their opinion *Cluytia collina* belonged in the genus *Cleistanthus*. This was accepted as a valid combination in the Index Kewensis and by Hooker and Thompson (Fl. Brit. Ind. **5**: 274, 1890). They attributed the combination to Bentham alone; but, today, in lack of clear proof, it is attributed to Bentham and Hooker, who signed the volume as joint authors.

Returning to *Canavalia galeata*, it appears to have been published in a similar and truly comparable manner. The present writer defended and accepted this combination as valid (Bishop Mus., Occ. Papers **15**(*22*): 233, 1940), but several younger botanists have written indicating that they were not convinced that the combination was actually made by Hooker and Arnott and so they rejected it. The following details and discussion should clarify the matter.

O. E. Schulz published an extensive monograph of the genus *Cardamine*. Its concluding pages listed the "Species exclusae" or species to be excluded from the genus *Cardamine*. In this section (Engler's Bot. Jahrb. **32**: 595, 1903) he wrote, and we quote in full:

"*C. sarmentosa* Solander apud Forster Fl. Insul. Austral. Prodr. Append. 91 (1786) = Nasturtium." The argument against this publication is that no attempt to make a new binomial can be valid unless the two names are printed in juxtaposition, the specific directly following the generic name. That is the usual manner of publication, and the literalist argues that no name can be a binomial unless it is printed as a binomial. The issue has to be settled by the application of the International Rules of Botanical Nomenclature and their interpretation by botanists. In the last edition, the rules adopted at Cambridge, 1930, and amended at Amsterdam, 1935, there are the following provisions: (1) a name or combination must be effectively published, that

is printed and distributed or sold (Art. 36); (2) it must include the reference to the basinym (Art. 37, and 44); (3) it must be accepted by the publishing author himself (Rec. XXII, also Art. 37ter, see Rec. Syn. 41, 1930). Condition 1 is complied with, as the paper was printed in a well-known botanical journal. Condition 2 is complied with, since the full basinym or name-bringing synonym is included and the full and correct reference to the place of publication is included. Condition 3 is complied with, since the author says *C. sarmentosa* = *Nasturtium*. That is, Forster's *Cardamine* is a *Nasturtium*. It is a positive placement of the species in *Nasturtium* without any expression of doubt, use of a question mark, or any other qualification. But, the argument has been made that no one can be credited with making such a combination or binomial unless he definitely publishes the two names in sequence, as *Nasturtium sarmentosum*. O. E. Schulz did not do exactly this. Hence, it has been argued, he cannot be credited with publishing the combination.

The International Rules have recently been codified, amended, and adopted by the botanists of the world. The rules are made retroactive to the basic Species Plantarum of Linnaeus in 1753. Modern botanists follow as a standard the provisions of these rules. They also apply them to the publications of the early botanists who worked previous to the framing of the rules. This retroactive application has always been done as leniently as possible. The citation of the basinym may be given incompletely and the name of the first author may be incompletely stated or even omitted, but if we can by detective means figure it out, it is accepted. The reference may be given only in part or it may be wholly omitted, but if we can complete it or ascertain it from the first author's name, we accept it. So, with these earlier authors we do not quibble over the letter of the law. For condition 3, no concessions are possible. There remains only the question of whether a binomial is valid when published so as to fulfill all the other conditions, but not printed with the specific name directly following the generic name. There are numerous such examples that have been accepted, but we will discuss only one in detail (Linnaeus' Species Plantarum, edition 1). In that standard and basic book the generic name for each genus is centered and printed in large capitals, followed by a period. The names of the one or more species are in the margin of the page, printed in italics in small letters or in small letters and capitals. In the introduction is the explanation, "Trivialia nomina in

margine apposui, ut missis ambagis, uno quamlibet Herbam nomine complecti queamus." The explanation given is that the specific names placed in the margin of the pages of his book may be put together as the name of the plant, if we please. The botanists of the world were very much pleased with the scheme of a binomial for each plant as proposed by Linnaeus. It was adopted immediately as the standard method, and it has so continued. Our modern scientific nomenclature begins with this book. Linnaeus used separate generic and trivial (specific) indices, so not even in the index are the two names of his binomial put together. If we are to insist that no plant name can be accepted as a binomial unless it was originally printed with the generic and specific names juxtaposed, then all or nearly all of Linnaeus' binomials must be rejected as invalid. The fact is, they have been and are universally accepted by the botanists of the world. Other authors could be cited as examples, but Linnaeus is sufficient. If Linnaeus' binomials are valid, and the botanical world is unanimous in accepting them, then we must accept similar forms of publication by other botanists. Hence, we must accept *Nasturtium sarmentosum* as effectively and validly published by O. E. Schulz. Though the details of the issue were not discussed, this binomial combination by O. E. Schulz was accepted by K. Rechinger (K. Akad. Wiss. Wien Math.-Naturwiss., Denkschr. **85**: 286, or reprint 112, 1910), and by C. Skottsberg (Nat. Hist. Juan Fernandez and Easter Island **2**: 72, 1921).

2. **Cardamine hirsuta** Linnaeus, Sp. Pl. ed. 1, **2**: 655, 1753.
   See treatment by O. E. Schulz (Engler Bot. Jahrb. **32**: 464-468, 1903) and G. Hegi (Ill. Fl. Mittel-Europa **4**(1): 340-342, tab. 125, fig. 3, tab. 133, fig. 4, 1919).

HAWAIIAN ISLANDS

Hawaii Island: Kilauea, Volcano House, July 6, 1933, student collection 100. The recent and only collection at hand.

3. **Cardamine konaensis** St. John, sp. nov. (fig. 1).
   C. hirsuta Linnaeus sensu Gray, U. S. Expl. Exped. Bot. **15**(1): 50, 1854, second variant, non L; sensu H. Mann Jr., Essex Inst., Comm. **5**: 116, 1866 and Am. Acad. Arts Sci., Proc. **7**: 149, 1867 as to specimen, not as to description which is largely compiled and in sensu L.

C. flexuosa Withering subsp. *debilis* (D. Don) O. E. Schulz, Engler Bot. Jahrb. **32**: 478-479, 1903, in part, as to Hawaiian records, not *C. debilis* D. Don (1825).

C. flexuosa Withering var. *haleakalensis* O. E. Schulz, Engler Bot. Jahrb. **32**: 480, 1903.

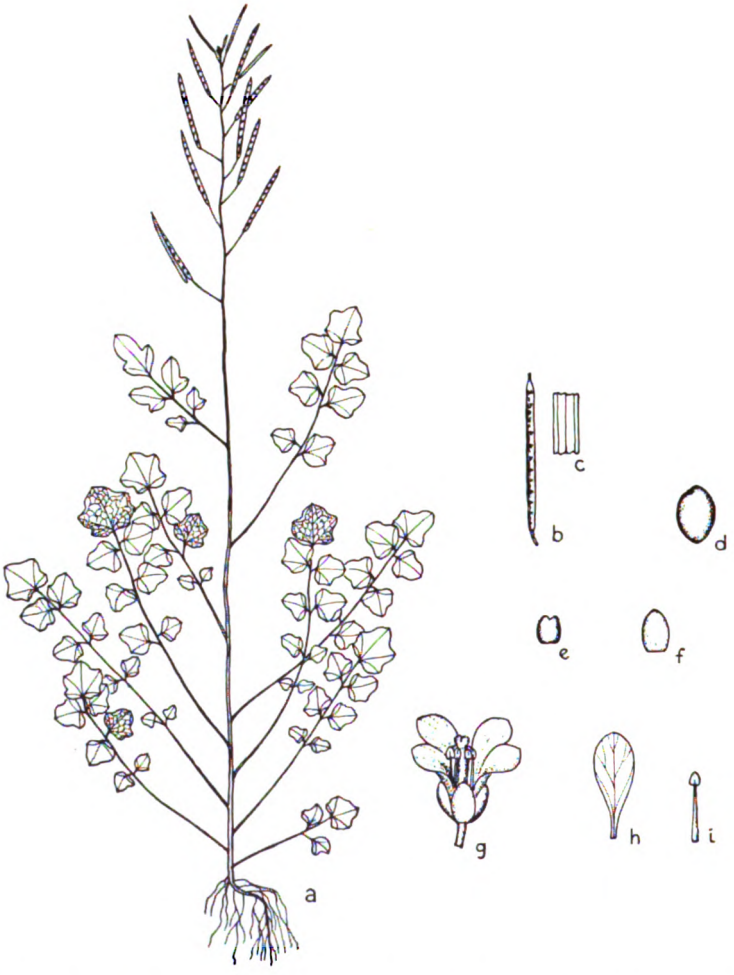

FIGURE 1.—*Cardamine konaensis* St. John. **a**, habit × ½; **b**, silique × 1; **c**, valve × 3; **d**, seed × 5; **e**, staminal nectary × 70; **f**, sepal × 5; **g**, flower × 5; **h**, petal × 5; **i**, stamen × 5.

Annua glabra, caulibus 12-24 cm. altis, foliis imparipinnatis (1)-2-3-jugis, foliolis lateralibus caulinis 4-10 mm. longis suborbicularibus 3-5-lobatis, foliola terminalia majore subcordataque, racemis 2-11 cm. longis ebracteatis, sepalis 1-1.2 mm. longis lanceo-ellipticis, petalis 2-2.7 mm. longis albis ellipticispathulatis, staminibus 6 inclusis, siliculis 15-23 mm. longis subcompressis, loculis 9-13-seminiferis, seminibus 0.9-1 mm. longis ovalibus brunneisque.

Annual; roots fibrous; plant glabrous, erect, 12-45 cm. tall; stem simple or slightly or even bushily branched; leaves all odd-pinnate, alternate; radical leaves several but not rosulate, membranous, 2.5-6 cm. long; petioles 1-3 cm. long, slender, not auriculate; lateral leaflets (1)-2-pairs, opposite or subalternate; the petiolules 1-2 mm. long, slender; the lateral leaflets 3-6 mm. long, 3-6 mm. wide, oblate-suborbicular to suborbicular or rarely oval in outline, with 3-5 rounded lobes, often apiculate at the apices, the base asymmetric cuneate or rounded; the terminal leaflet about a tenth larger, broader and subcordate at base; cauline leaves numerous, borne almost up to the inflorescence, not crowded, 2-6 cm. long; the petioles 1-2 cm. long; lateral leaflets 2-3-pairs, the petiolules 2-6 mm. long, the leaflets 4-17 mm. long, 3-13 mm. wide, suborbicular to oblate-suborbicular to oblanceolate in outline with 3-5 deep, prominent rounded lobes apiculate at the apices; terminal leaflet 7-22 mm. long, 9-13 mm. wide, similar to the lateral ones but slightly larger and often subcordate at base; inflorescence bractless, of one or more terminal racemes, in fruit loose and 2-11 cm. long; pedicels at anthesis 1-2 mm. long, in fruit 2.5-9 mm. long, ascending at 45 to 50 degrees divergence from the axis, the lowest upcurved, the others straight; sepals 1 mm. long, ovate, pale greenish, the margins membranous; the 4 petals 2.5-3 mm. long, white, the claw narrow, half as long as the elliptic limb; the 2 nectaries cylindric, minute; stamens 6, subequal; filaments 1.3-1.7 mm. long; anthers 0.3-0.4 mm. long, elliptic-sagittate; style short and at first slender, but thickening and thus becoming inconspicuous; ovary glabrous; capsules 15-23 mm. long, 0.8-1 mm. thick, slightly but distinctly flattened parallel to the partition, narrowly linear, abruptly narrowed to the pointed apex, the style and sub-bilobed stigma only 1 mm. long; valves with about 3 dorsal longitudinal nerves and various interconnection cross nerves; each valve 9-13-seeded; seeds 0.9-1 mm. long, 0.7 mm. wide, oval, brown.

Hawaiian Islands

Maui: Wainee Gulch, West Maui, May 1910, *C. N. Forbes 80.M;* Haleakala Crater, Kaeanae [= Keanae] Gap [now called Koolau Gap] Aug. 2, 1919, *C. N. Forbes 1000.M;* Haiku Uka, Waikamoi Stream, steep moist bank, 4,400 ft. alt., Aug. 4, 1943, *H. St. John 20357.*

Hawaii Island: Kona, woods, 3,000 ft., *W. Hillebrand and J. M. Lydgate;* Kona, woods, *H. Mann and W. T. Brigham 311;* Kona, Papaloa [= Papaaloa], in the koa forest, July 15, 1911, *C. N. Forbes 322.H;* Puu Oo, forest below, June 16, 1915, *C. N. Forbes 861.H* (type in Bishop Museum); Puu Hualalai, Puuwaawaa, moist woods, 6,000 ft. alt., Dec. 29, 1931, *H. St. John et al. 11391.*

This plant, indigenous to the forests of Hawaii and Maui, is quite unlike the narrow leafleted *C. hirsuta* which occurs on the islands only as an adventive. The monographer, O. E. Schulz, included the Hawaiian plant in *C. flexuosa* Withering ssp. *debilis* (D. Don) O. E. Schulz which he cited from a vast area from India to Japan, to Java, Hawaii, and Mexico. His basinym was *C. debilis* D. Don, Prodr. Fl. Nepal. 201, 1825 (*C. Hamiltonii* G. Don, Gen. Hist. Dichl. Pl. **1**: 167, 1831) a native of India with simple radical leaves; the cauline leaves with opposite leaflets; and the siliques filiform. This is evidently different from the plant of Hawaii and the name is also a later homonym of *C. debilis* Banks ex A. P. DeCandolle (Syst. Nat. **2**: 265, 1821) based on *Sisymbrium heterophyllum* Forster filius (Prodr., 46, 1786) a different plant of New Zealand with granular hirtellous ovary and silique, now called *C. heterophylla* (Forster filius) O. E. Schulz, which species is also distinct from, but probably the closest relative of the Hawaiian one. *Nasturtium obliquum* Zollinger (Flora **30**: 659, 1847) from Java was listed by O. E. Schulz as a synonym of ssp. *debilis,* but according to the treatment and drawing by S. H. Koorders (Excursionsfl. Java **2**: 290, 1912) where it is treated as a straight *C. hirsuta* Linnaeus, this Javan plant differs in appearance from the European *C. hirsuta,* and from the Hawaiian plant in its cauline leaves with oval, sinuate margined lateral leaflets and narrower terminal leaflets. The two Indian varieties also given as synonyms by O. E. Schulz seem remote from the Hawaiian plant. Thus, though frequently collected and listed under various binomials, this indigenous plant of the woodlands of Hawaii and Maui, seems to be unnamed.

Cardamine flexuosa Withering var. *haleakalensis* O. E. Schulz was described from a single collection by W. Hillebrand on the north side of Haleakala at 2,000 meters altitude. It is rare and very little material has accumulated. Local botanists have not confirmed this as a separate Hawaiian endemic. On August 4, 1943 the writer found a large colony of *Cardamine* at 4,400 feet on the steep, moist bank of the gulch above the second dam of Waikamoi Stream, Maui. There were many plants; those fully exposed to the sun, on moist muddy soil, were only 1 dm. tall and the leaves, both the basal and cauline, bore only the suborbicular type of leaflets. There was a gradual and complete transition to the larger plants growing in moist shaded spots, with stems up to 45 cm. tall, and the cauline leaves with the lateral leaflets oblanceolate. This shade form is what was described as

C. flexuosa var. *haleakalensis*. From these field studies it is now clear that the taller plants with narrower leaflets are not a distinct variety of *C. flexuosa* of the moist shady forests of cold temperate Europe.

4. **Cardamine flexuosa** Withering forma **umbrosa** (Grenier and Godron) O. E. Schulz in Engler Bot. Jahrb. **32**: 476, 1903; Hegi, G., Ill. Fl. Mittel-Europa **4**(1): 343, fig. 819, a, b, c, 1919.
   C. sylvatica Link *β umbrosa* Grenier and Godron, Fl. France **1**: 110, 1848.

HAWAIIAN ISLANDS

Maui: Honokahau Drainage Basin, Sept. 25 to Oct. 17, 1917, *C. N. Forbes 488.M.*

Hawaii Island: Hawaii National Park, Kilauea C. C. C. Camp, only a few plants, in partial shade under building, Feb. 10, 1943, *G. O. Fagerlund and A. L. Mitchell 309.*

As O. E. Schulz states, this is a variant found in heavy shade. It is apparently an adventive plant that is still uncommon. It has not previously been recorded from the islands. This form is placed by O. E. Schulz under var. *interrupta* Čelakovský; but, since the form lacks the small secondary leaflets diagnostic for the variety, it is listed here separately. This was also done by Hegi.