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New Distinctions Between *Alysicarpus vaginalis* and *A. ovalifolius* (Leguminosae)

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Abstract *Alysicarpus vaginalis* and *A. ovalifolius* are leguminous plants distributed in tropics of the Old World. *A. ovalifolius* has been considered as a distinct species or as identical with *A. vaginalis,* or as a variety of *A. vaginalis.* We found new characters distinguished between them. Pods of *A. vaginalis* are slightly constricted between articles and each article has septa at both ends, while those of *A. ovalifolius* are not constricted at the joint and each article has no such septa. We treat them to be distinct species. These differences are important as a character in relation to seed dispersal method. By these key characters we re-examined herbarium specimens and found that *A. ovalifolius* occurs in Japan.

Key words : Leguminosae, *Alysicarpus,* pod, septate, eseptate.

The genus *Alysicarpus* Desv. of subfamily Papilionoideae in Leguminosae, contains about 25 -30 species, and is distributed in tropics of the Old World (Ohashi et al., 1981). Fruits of *Alysicarpus* are linear-oblong, indehiscent, compressed, subcylindrical, several-jointed, straight or constricted between the segments, mostly with raised reticulate nerves on the lateral surfaces.

Alysicarpus vaginalis (L.) DC. and *A. ovalifolius* (Schumach.) J. Léon. are distinguished from other species of the genus by characteristics of pods. These two species have the pods with not so conspicuously constricted between the articles. On the other hand the pods of the others are strongly or at least definitely constricted between the articles and both sutures are not at all straight.

Due to the overall similarity, especially in pod characters, these two species have often been regarded as conspecific (Schindler, 1928).

Differences of the two species, given by Léonard (cited by van Meeuen, 1961), are as follows. *A. ovalifolius* would be an annual with lax racemes of which internodes are longer than the flowers. *A. vaginalis* has dense racemes of which internodes are usually shorter than the flowers, and is perennial with often creeping rooting stems. Van Meeuen, who examined the Malaysian material, mentioned, "In the materials I have seen ... the internodes are generally slightly longer than the flowers. In the specimens Léonard cited from Malaysia (...) to belong to *A. ovalifolius* exceed the internodes; therefore I find no reason to recognize it as a different species; it may be an African race."

Verdcourt (1971) found an additional character to distinguish between the two species. A reticulation pattern is prominent on both surfaces of leaflets in *A. vaginalis,* but that is obscure in *A. ovalifolius.*

In East Africa, however, these differentiations between the two species are very unsatisfactory (Verdcourt, 1971). He mentioned, "I would be tempted to consider them merely as varieties of one species but since Léonard's study was exhaustive I merely point out that more data are needed (Verdcourt, 1971)". And he had followed Léonard in maintaining the two as separate species (Verdcourt, 1974).

In this paper taxonomic relationships between theses two species are studied carefully by using a scanning electron microscope (SEM).

Materials and Methods

We have examined specimens preserved in the herbarium of the Biological Institute, Faculty of Science, Tohoku University (TUS) and fresh materials collected in Taiwan. The specimens were collected mostly in East Asia and were determined as *Alysicarpus vaginalis.* Pods are transversally and longitudinally sectioned with razors. After the coating with gold or platinum

palladium, seeds and the sections of pods are observed by Jeol JSM-840 SEM or Hitachi S-2100A SEM.

Observations

Pods of *Alysicarpus vaginalis* are pubescent with hooked hairs (Figs. 1 A, 3 M) and slightly constricted between articles (Figs. 1 A, C, 3 M). Two septa are observed in the inside of pods at each joint (Fig. 1 E, G) and this fact shows each article has a septum at the joint. When mature the pod is easily separable into one-seeded articles. The separation occurs at the constriction (Fig. 1 C) between two septa. Each seed is completely enclosed within the article. On the other hand, pods of *A. ovalifolius* have low ridges along margins of articles at the joints (Figs. 1 B, D, 3 N). There is not septum in the inside of pods at joints (Fig. 1 F, H) but two undeveloped traces of septa (Fig. 1 F). Sometimes there are septa only at the distal joints of pod in *A. ovalifolius*. When mature the seeds move from one article to another in the eseptate pod after separating from the funicle. The pods of *A. ovalifolius* separate into articles harder than those of *A. vaginalis* do. When separate all seeds are put out of the pods at eseptate joints. The hooked hairs on pods of *A. ovalifolius* are fewer than those of *A. vaginalis* (Figs. 1 B, 3 N).

Figure 2 shows the relationships between number of internodes in inflorescences and length of the inflorescence (measured from most basal node to uppermost one) of *A. vaginalis* and *A. ovalifolius*. Comparing the length of inflorescences having same number of internodes between these species, the inflorescences of *A. ovalifolius* are longer than those of *A. vaginalis*. It means that the average length of internodes of inflorescences of *A. ovalifolius* is longer than that of *A. vaginalis*. The variation of those relationships tends to show distinctions between these two species.

Standards (Fig. 3 C, D) are ovate or rounded, and narrowed to a claw, with 2 small longitudinal folds near the base; wings (Fig. 3 E, F) adhere to the keels (Fig. 3 G, H). Calyces (Fig. 3 A, B) are 5-lobed, and the upper two lobes are shorter than the others. Ovaries (Fig. 3 K, L) are pubescent; styles are filiform and incurved at the apex. Vexillary stamens (Fig. 3 I, J) are lightly adnate to the filament tube.

The seeds are ellipsoid (Fig. 4 A, B) and compressed (Fig. 4 C, D) with inconspicuous regular rim-arils (Fig. 4 E, F).

Discussion

Alysicarpus vaginalis and *A. ovalifolius* are distinguishable each other by presence or absence of constriction and septum at the joint of pod. These characters are more or less related to the length of internode of inflorescence.

Alysicarpus vaginalis and *A. ovalifolius* have a different dispersal mechanism of seed due to presence or absence of the septa in pods. When mature the pods of *A. vaginalis* are easy to fall separately into one-seeded articles. The seeds are completely enclosed within septa and a part of pericarp. The pericarp is covered with hooked hairs. Then the seeds are dispersed widely by adhesion to animals. On the other hand, when the eseptate pods of *A. ovalifolius* separate apart at any joints, all seeds are put out of pods. In such a case the dispersal of seeds can not be done by adhesion to animals, but probably by ants.

From the morphological and functional points of view the pods of *A. vaginalis* and *A. ovalifolius* are very different each other. These characters of pod are correlated to the length of internode of inflorescence. Therefore, we consider that *A. vaginalis* and *A. ovalifolius* are distinct.

Alysicarpus vaginalis (L.) DC., Prodr. 2: 353 (1825). Léonard in Bull. Jard. Bot. Brux. 24: 84 (1954). Verdcourt in Fl. Trop. E. Afr. Leg.-Pap.: 493, f.71-A (1971). Verdcourt in Kirkia 9(2): 546 (1974). Ohashi *et al.* in Sci. Rep. Tohoku Univ. ser. (Biology) 39: 208 (1988).

Pods (0.5-)1.3-2.2 cm long, 2.2-2.7 mm wide, generally pubescent with hooked hairs, indehiscent, with two septa developed at each joint, slightly constricted between the articles at the joint, easily separable when mature into one-seeded articles; articles (1-)4-7(-8).

Japanese name: Sasahagi.

Specimens examined (all in TUS). **RYUKYU ISLS.**: Tokunoshima Isl. *H. Migo* on July 27, 1964; Taketomi Isl. *Y. Niiro 6326*; Hateruma Isl. *Y. Miyagi 6852*; Iriomote Isl. *H. Ohashi & Y. Tateishi 1294, 1665, 1678, F. Yamazaki* on Mar. 21, 1968. **FORMOSA**: *Y. Tateishi et al. 15693, 16334*, on Nov. 11, 1982, *H. Ohashi et al. 13480, 14402,*

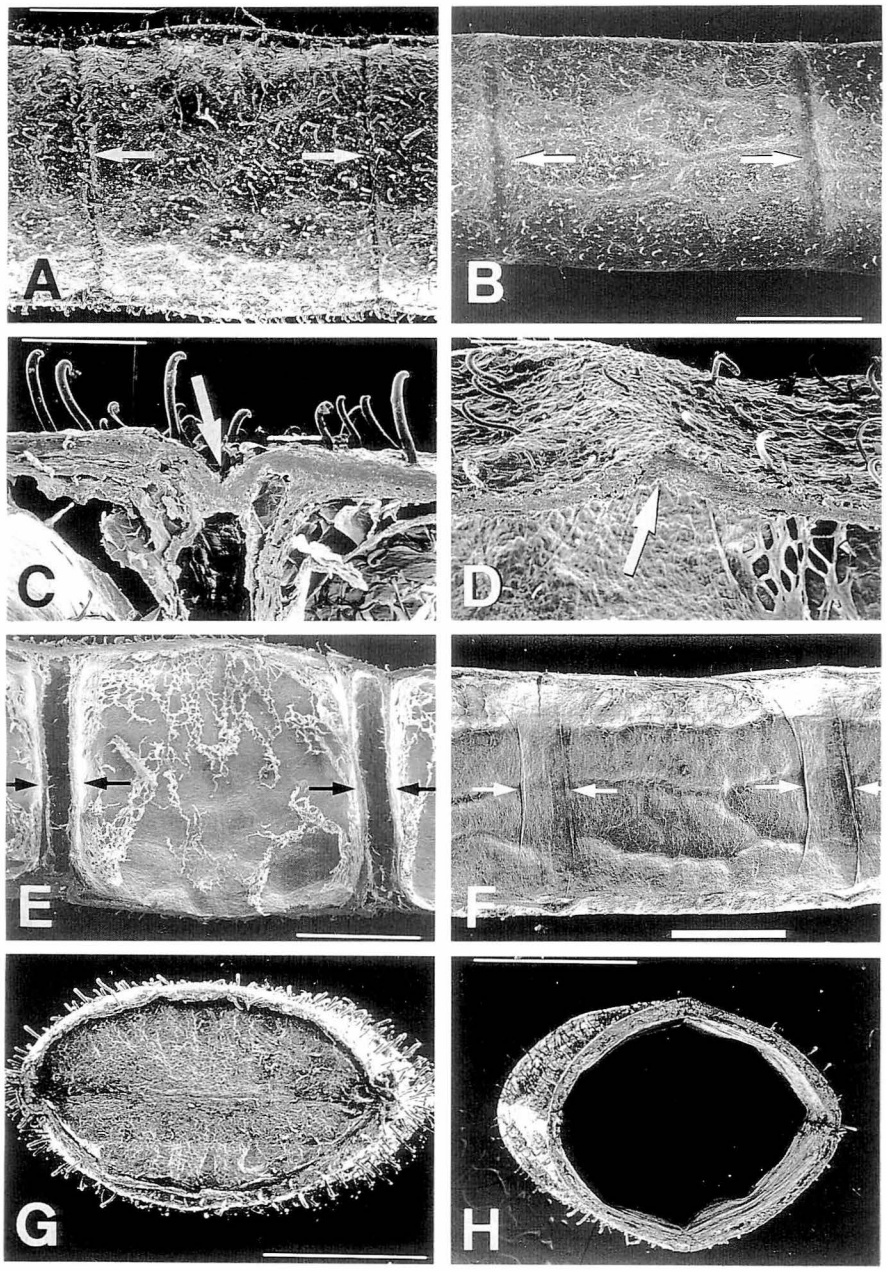

Fig. 1. Scanning electron micrographs of pods of *Alysicarpus vaginalis* (A, C, E and G) and *A. ovalifolius* (B, D, F and H). A, B: Outer surface covered with hooked hairs [arrows indicate constrictions (A) and ridges (B) between articles]. C, D: Longitudinal sections of constriction (C) and the ridge (D) between articles (view from lateral side). E, F: Longitudinal section (view from upper suture) [arrows indicate the transverse septa (E) and the trace of septa (F) at the joints]. G, H: Transverse sections at the joint with septum (G) and without septum (H). Scale bars indicate 1 mm (A, B, E, F, G and H) or 0.2 mm (C, D). Voucher specimens: *A. vaginalis* [Formosa, Pingtung Co. *H. Ohashi & T. Nemoto 20064* (TUS)] and *A. ovalifolius* [E. Nepal, Arun Valley *Y. Tateishi 8569* (TUS)].

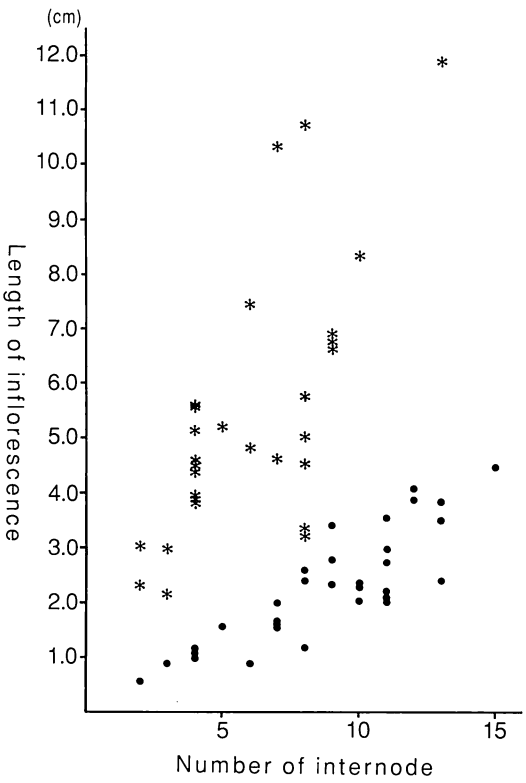

Fig. 2. A scatter diagram showing relationships between number of internode and length of inflorescence of *Alysicarpus vaginalis* (●) and *A. ovalifolius* (*).

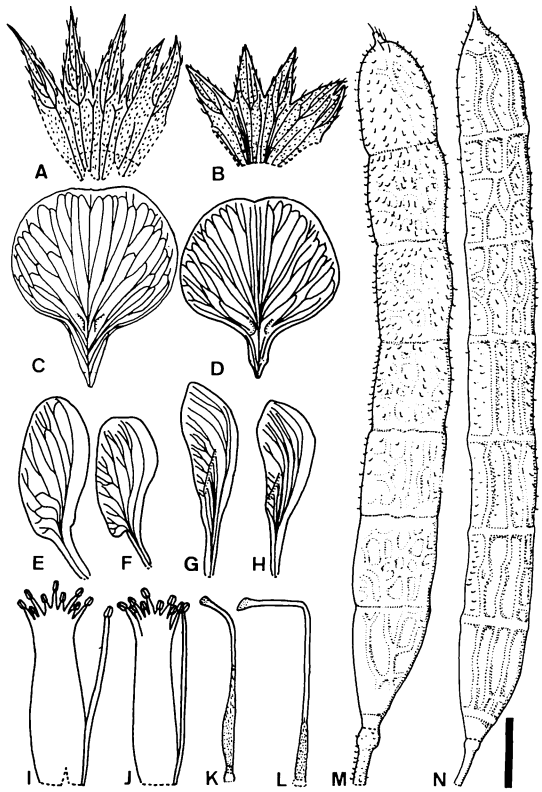

Fig. 3. Flowers and fruits of *Alysicarpus vaginalis* (A, C, E, G, I, K and M) and *A.* ovalifolius (B, D, F, H, J, L and N). A, B: Calyx dissected (view from outside). C, D: Standard. E, F: Wing. G, H: Keel-petal. I, J: Androecium dissected. K, L: Gynoecium. M,N: Fruit (calyx removed). Scale bar indicates 2mm. Voucher specimens: Flowers of *A. vaginalis* [Formosa, Pingtung *Y. Tateishi et al.18440* (TUS)] and *A. ovalifolius* [Formosa, Pingtung *H. Ohashi & T. Nemoto 21359* (TUS)] ; fruits of *A. vaginalis* [Formosa, Pingtung *H. Ohashi & Y. Endo 20429* (TUS)] and *A. ovalifolius* [E. Nepal, Arun Valley *Y. Tateishi 8569* (TUS)].

T. C. Huang on Nov. 5, 1981, *C. E. Chang 14510,* on Apr. 19, 1980, *T. Makino* on Nov. 15, 17 & 21, 1896, *K. Miyake* on June 1, 1900. **HAINAN ISL.**: *T. Tuyama 81523.* **OGASAWARA ISLS.**: Chichi-jima Isl. *T. Yamazaki* on May 25, 1970. **GUAM ISL.**: *Y. Hasegawa 7216.* **SHINGAPORE**: *M. Togashi* on Jan. 3, 1962. **LUZON ISL.**: *J. Murata 10205.*

A. ovalifolius (Schumach.) J. Léonard in Bull. Jard. Bot. Brux. 24: 88, f. 11 (1954). Verdcourt in Fl. Trop. E. Afr. Leg.-Pap. 493, f. 71-B (1971). Verdcourt in Kirkia 9(2): 547 (1974). Sanjappa & Bhatt in J. Bombay Nat. Hist. Soc. 75: 254, f.1 (1978). Ohashi *et al.* in Sci. Rep. Tohoku Univ. ser. (Biology) 39: 207 (1988).

Hedysarum ovalifolium Schumach., Beskr. Guin. Pl. 359 (1827).

A. vaginalis auct. non (L.) DC.: Baker in Hook. f., Fl. Brit. Ind. 2: 432 (1931), p.p.; van Meeuen in Reinwardtia 6: 87 (1961), p.p.; Huang & Ohashi in Fl. Taiwan 3: 168 (1977), p.p.

Pods (0.5-)1.5-2.0(-2.2) cm long, 1.8-2.3 mm wide, indehiscent, puberulus with hooked hairs, mostly without septa but sometimes with septa at the distal joints, encircled by low ridges at joints, separable at the joints into articles; articles (1-)4-6(-8).

New Japanese name: Fushinashi-sasahagi.

Specimens examined (all in TUS). **RYUKYU ISLS.**: Isl. Minami daitou-jima *Y. Miyagi* on Sep. 16, 1973. **FORMOSA**: *H. Ohashi et al. 14856,*

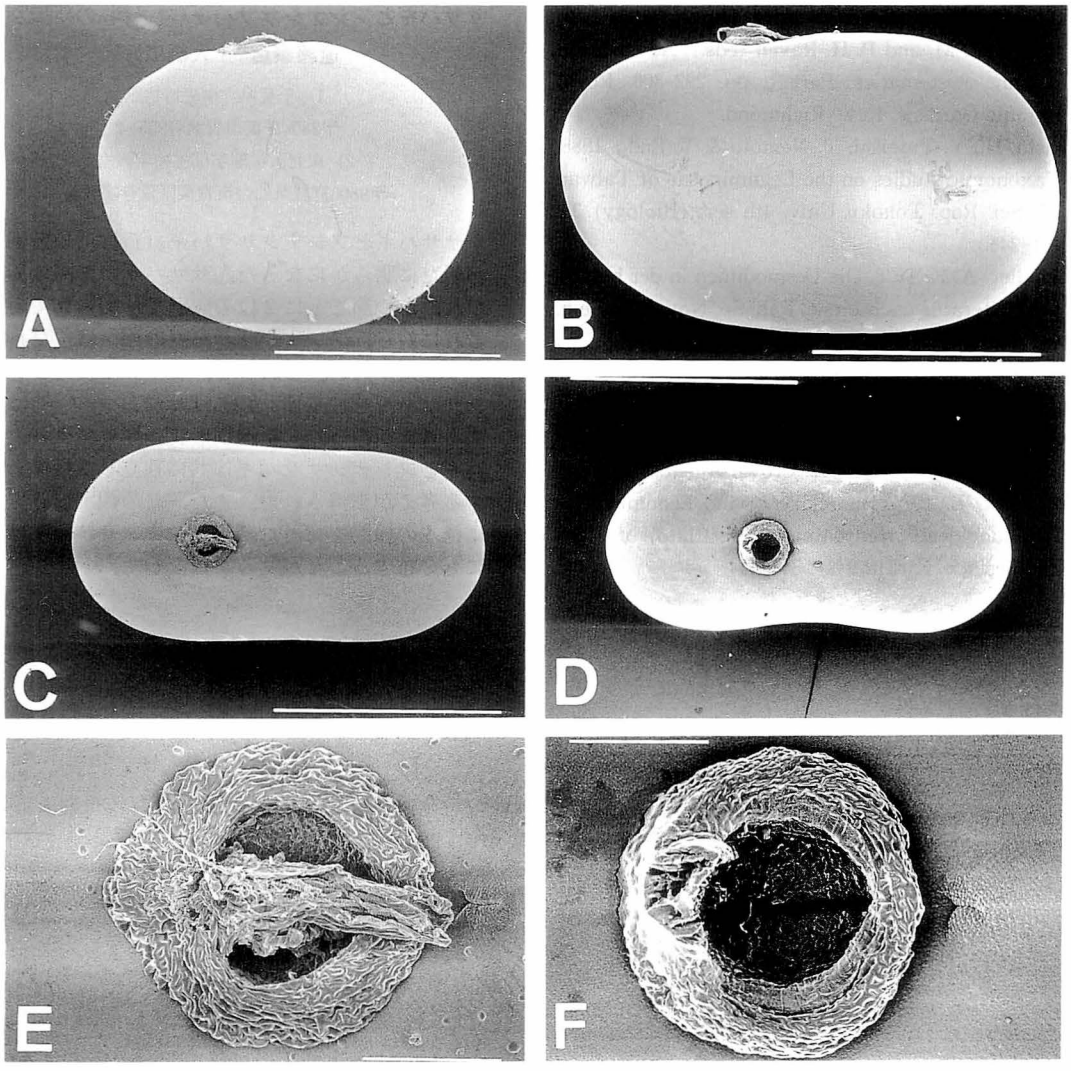

Fig. 4. Scanning electron micrographs of seeds and hila (E, F) of *Alysicarpus vaginalis* (A, C and E) and *A. ovalifolius* (B, D and F). Voucher specimens: *A. vaginalis* [Formosa, Pingtung Co. *H. Ohashi & T. Nemoto 20064* (TUS)] and *A. ovalifolius* [E. Nepal, Arun Vally *Y. Tateishi 8569* (TUS)]. Scale bars indicate 1 mm (A-D) or 0.1 mm (E, F).

14612, 15007, 14642, 14858 & 13593, C. L. Huang 992, U. Faurie 1353, T. Makino on Nov. 24, 1896. **PHILIPPINES:** *J. Murata 10210.* **NEPAL:** *Y. Tateishi 8569.* **DARJEELING:** *H. Ohashi 774348.*

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References

Léonard, J. 1954. Notulae Systematicae XV Papilionaceae- Hedysareae Africanae (*Aeschynomene, Alysicarpus, Ormocarpum*). Bull. Jard. Bot. Brux. 24: 63-106.

Meeuen, M. S. van, C. G. G. J. van Steenis and J. Stemmerik. 1961. Preliminary revisions of some genera of Malaysian Papilionaceae II. Reinwardtia 6(1): 85-108.

Ohashi, H., R. M. Polhill and B. G. Schubert. 1981.

Tribe 9. Desmodieae (Benth.) Hutch. (1964). *In* Polhill, R. M. and P. H. Raven (eds.), Advances in Legume Systematics. Part 1, pp. 292-300. Royal Botanic Gardens, Kew. Richmond.

Ohashi, H., Y. Tateishi, T. Nemoto & Y. Endo. 1988. Taxonomic studies on the Leguminosae of Taiwan III. Sci. Rep. Tohoku Univ. 4th ser. (Biology) 39: 191-248.

Schindler, A. K. 1928. Die Desmodiinen in der botanishen Literatur nach Linné. Rep. Sp. Nov. Reg. Beih. 49: 253- 258.

Verdcourt, B. 1971. *Alysicarpus. In* Milne-Redhead, E. and R. M. Polhill (eds.), Flora Tropical East Africa, Leguminosae (Part 3) subfamily Papilionoideae (1), pp. 491-501. Crown Agents. London.

Verdcourt, B. 1974. Summary of the Leguminosae-Papilionoideae- Hedysareae (Sensu lato) of Flora Zambesiaca. Kirkia 9(2): 544-554.

ササハギとフシナシササハギ(マメ科)の新識別形質

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ササハギとフシナシササハギ（新称）の識別形質が新たに明らかになった．ササハギの節果は節でくびれ，かつ節ごとに2枚の隔壁で仕切られている．これに対し，フシナシササハギの節果はくびれず，かつ隔壁が無い．これまで，ササハギに対しフシナシササハギを独立種，変種，地域的レース（race）とする考えがあった．新識別形質の発見により，ササハギとフシナシササハギは共に独立した種であるとする考えが支持された．また，この識別形質をもとに標本の検討を行った結果フシナシササハギは日本にも分布することが明らかになった．