STUDY OF FRUITS MORPHOLOGICAL FEATURES FOR 33 SPECIES BELONG TO CRUCIFERAE FAMILY IN IRAQ

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ABSTRACT

The research was aimed to identify fruits morphological characteristics of 33 taxa belonging to the Lepidieae tribe from Brassicaceae. The characteristics of the fruit's general shape, apex shape, dimensions, colors, surface ornamentation, and beak were determined, the results indicated the importance of each of those characters in isolated species, In general, all the tribe's fruits were open capsule and short silicula. According to the dimensions of fruit, three species can be distinguished as a group with dimensions greater than 20mm, as in *Brossardia*, *Coluteocarpus*, and *Didymophysa*, and depending on the shape, it was possible to differentiate the species within this group, while the other species were less than 20 mm. in dimensions. They were distinguished by the general shapes, as the fruits of the *Aethionema* species were distinguished by their winged shaped, whereas the fruits of the genus *Biscutella* are bi-lobed, and the fruits have an inverted semi-triangular shape in the *Capsella* and peltate with prominent veins in the genus *Horwoodia*, or maybe peltate and longitudinally splintered with dark veins in *Iberis*, while the genus *Sameraria* fruit is circular to semi-circular characterized by intermediate appendages, while the individuals of the genus *Isatis* have linear-oblong fruits, and the species of both genus *Lipidium* and *Hymenolobus* were distinguished by their small and elliptic fruits and could be differentiated according to other fruits features. So could be conclude the importance of the characteristic of the general shape of the fruit firstly in species isolation then size, ornamentation, and some other traits.

Keywords: Brassica family, silicula, winged shape, elliptic, peltate

مجلة العلوم الزراعية العراقية -2021 :52 (4):1039-1049 الدبيسي والمسعودي

دراسة الصفات المظهرية لثمار 33 نوعاً تعود للعائلة الصليبية في العراق

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المستخلص

يهدف البحث الى تحديد الصفات المظهرية لثمار 33 مرتبة تصنيفية تعود لعشيرة Lepidiaea من العائلة الصليبية,وقد حدد كل من صفات الشكل العام للثمرة وشكل القمة والابعاد والالوان وصفات الزخرفة السطحية والمنقار, وقد دلت النتائج على اهمية كل من الصفات المذكورة اعلاه في عزل الانواع, ويشكل عام اتصفت ثمار العشيرة جميعها بكونها علبيه متفتحة قصيرة ذات طول اقل من ثلاثة اضعاف عرضها وبذلك تسمى ثمار خريدلية Silicula, وتبعا لصفات الابعاد امكن تمييز ثلاثة انواع ذات ابعاد اكبر من .20 mm كما في انواع الاجناس *Brossardia* و *Coluteocarpus* و*Didymophysa* وبالاعتماد على صفات الشكل امكن تفريق الانواع ضمن هذه المجموعة, اما باقي الانواع المدروسة فكانت ذات ابعاد اقل من .20 mm. وتم تمييزها بالاعتماد على الشكل العام اذ تميزت ثمار انواع جنس *Aethionema* بشكلها المجنح, اما ثمار جنس *Biscutella* فتكون ثنائية الفص, وتكون الثمار ذات شكل شبه مثلث مقلوب في الجنس *Capsella* ودرعيه الشكل ذات عروق بارزة في جنس *Horwoodia* او قد تكون درعية منشقة طوليا وذات عروق سوداء في جنس *Iberis*, بينما ثمار جنس *Sameraria*تكون دائرية الى شبه دائرية وذات زوائد وسطية, اما افراد جنس *Isatis* فكانت متطاولة خطية, وقد تميزت انواع كل من الجنسين *Lipidium* و*Hymenolobus* بثمارها الصغيرة والاهليليجية والتي امكن تفريقها تبعا لصفات الثمار الاخرى, وبذلك نستنتج اهمية صفة الشكل العام للثمرة بالمرتبة الاولى في تفريق الانواع ومن ثم كل من صفات الحجم والزخرفة وبعض الصفات الاخرى.

الكلمات المفتاحية: عائلة نبات الفجل, خريدلة, شكل مجنح , اهليجي , درعي

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INTRODUCTION

The tribe Lepidieae consist of 3-6 genera and more than 240 species as mention by Mitchell and heenan (19), and related to the Brassicaceae family, which is one of the major angiosperm families, involving approximately 340 genera and more than 3350 species in 10 defined tribes, distributed throughout the world, especially in temperate regions of the northern hemisphere (10). Some of the family species are important commercially and other used as decoration plants in garden as mention by Dizayee and Saleh.(13). Cruciferae family is classified into 13 Tribes: Arabideae, Hesperideae, Lepidieae, Matthioleae, Sisymbrieae, Alysseae, Brassiceae, Chamireae, Schizopetaleae, Stenopetaleae, Helphiteae, Cremolobeae, Drabeae according to some characters as the fruits (16). Fruits in the family are of taxonomic importance, as they relied on them to diagnose the family mainly, and most the systematics prepare the fruits as a basis for diagnosis (4,17,20). Schuz indicated in his study that fruits are consist of two main parts, the beak, and the valve and pedicelated. Mainly the family has two types of fruits, Silique, where the fruits are long and slender, and Silicule which are small and flat (5). *Cakile* (Mill) genus has also been diagnosed by Cordazzo (11) based on the composition of the fruits, which is dividing the fruit into two main parts, the long upper fruit part and the short lower fruit part.Al-Masoudi (6) was study six species belonging to the *Malcolmia* (R.Br.) genus, by using the morphological characteristics of the fruits to separate species, she also studied the size of the pedicel, as well as the type and density of the hairs in the fruits, and she was able to distinguish between the species belong to genus. The characteristics of some lepidieae species fruits of gens *Horwoodia* in Iraq were also studied by Al-Masoudi (7), which showed that the characteristics of the fruits are important diagnostic characteristics in distinguishing the plant species belonging to the family. while Fayed and El Naggar studied the importance of seed and fruit morphology in taxonomy of tribe Lebidieae in Egypt.(14) The current research aimed to study the morphological features of fruit for tribe Lepidieae by using LM to confirm the taxonomic important as a criterion for the segregation of genera and species studied.

MATERIALS AND METHODS

This study deals with dry herbal specimens deposited in some Iraqi Herbarium, which is the Baghdad University Herbarium (BUH) in the College of Science, National Herbarium of Iraq (BAG) in Baghdad, it used in the study dissecting microscope, slides, slide covers, dissection tools and Cannon digital camera. The morphological terms which are used mentioned by other researchers (3,9,11,17). The preparation of the examined samples ranged between (10-20) samples for each species and according to their availability.The fruits were examined for each species and studied characteristically (shapes, colors, dimensions and surface ornamentation or indumentums) by Dissecting microscopy, Take all notes and measurements.

RESULTS AND DISCUSSION

The results of the current study, which included the fruits features of 33 species, indicated that the fruits are all opened capsule, short and with a length of fewer than three times their width, and thus are called Silicula fruits, which are among the characteristics of the Lepidieae tribe belonging to the Cruciferae family, as mentioned by Hedge *et al.* (15) and Linnaeus (14) which were found through their study of the species the importance of the morphological features the fruit in isolation of taxonomic ranks and divided the family based on fruits shapes into long-fruit

Siliquosae and short-fruit Siliculosae. While Heywood (13) used additional characters to isolate the different genera of the subtribe - Brassicinae, such as the number of veins on the valve fruit as well as other characters such as the length and width of the valve, the presence of hairs, the number of seeds, the length and shape of the beak and other characteristics. The study included the identification of several morphological characteristics that showed the importance of isolating and distinguishing different taxonomic ranks within the Lepidieae tribe. According to the fruits shape of *Aethionema* which was characterized by winged fruits with splinter apex concave, and these results similar to Al-Brahimi results (1) which is found in her study of genus, As for the species level, the characteristics of shape, color, and wing edge of the fruit have shown importance in isolating the species. As for the monotypic *Biscutella*, its members were distinguished by having two-lobed fruits with glandular hairs, Because of the importance of the shape of the fruits by isolating the individuals of the species, the species was called *B. didyma*, meaning the two-lobe, according to the shape of the fruits. Among the fruits characteristic fruits of the monotypic species, *Brossaardia papyracea* of large size compared to the other species fruits of the studied tribe, as it reached (23×25)mm of flat elliptical broad flat with glandular hairs centered at the apex (Figure1). As for the *Capsella bursa-pastoris* species, its individuals were distinguished by the shape of the inverted triangular fruits with concave apex (Figure2). Observing the shapes and ornamentation of the fruits, it was possible to isolate and separate the individuals of *Cardaria draba* which are distinguished by the inverted oval shape with the coarse tuberculate surfaces (Figure3). More other characteristic of the fruits of the family is the large vesicular fruits, which may be in the shape of a single yellow vesicle, tuberculate ornamentation, as in the species *Coluteocarpus versicarria* (Figure 4). Or, the fruits of the bi vesicle are yellow with purple-colored tuberculate, as in *Didymophysa aucheri*, and thus both the shape and the ornamentation characteristic are important in separating the two species. (Figure5). As for the type *Cornopus squamatus*, a study of the characteristics of fruits for its members showed the importance of color, shape, and ornamentation, as it was distinguished by black or dark brown fruits with a curly surface and with an inverted cordate shape, which distinguishes it from the other tribes species in research (Figure5). Among the characteristics of some fruits are the emergence of veins and their coloration and the presence of some appendages or accessories, as the species *Horwoodia dicksoniae* was distinguished by peltate shape fruits with prominent reticulate green veins in color similar to study of (7) (Figure5). As for the species *Iberis acutiloba*, it was distinguished by peltate fruit splintered longitudinally by wide vein with a butterfly-like shape and characterized a reticulate vein brownish-black to black (Figure5).As for the species of the genus *Sameraria*, its fruits were distinguished by the presence of central appendages, they may be curved appendages, as in species *S. stylophora* or acute appendages as species *S. armena* (Figure4). As for the species of the genus *Isatis*, its members were distinguished by Linear-oblong fruits (Figure 4,5). Differences between them, depended on the variations in the surface ornamentation, some of which are black and have dense white hairs, basal position, as in species *I. cochlearis*, or they are aggregate lateral yellow hairs as inspecies *I. lusitannica*, or they are yellow, smooth, as in the species *I. buschiana*, except for the species *I. cappodocica*, which is distinguished by large peltate shape fruit,

different from the fruits of other species of the genus, some have dense hairs and some are smooth, as well as many differences between individuals of the species due to the presence of several taxonomic ranks within the species and as indicated by Aldobaissi (2). According to the sizes of the fruits, the fruits of some species were distinguished by relatively small sizes, including the species *Hymenolobus procumbens*, characterized by smooth elliptical fruits of the archeological beak. *Lepidium* genus has elliptical to smooth circular fruits characterized by a wide and distinct vertical beak, to isolate the species of the genus *Lepidium*, it is possible to rely on the characteristics of the shape and the surface ornamentation. and that was agreement with Hedge *et al*. (12). Through what was mentioned previously it became clear the importance of studying the morphological characters of the Cruciferae species in isolating the diagnosis of different taxonomic ranks and adopting them as a distinctive characteristic in establishing the taxonomic key to the family. This study was showed the importance of the characteristic of the general shape in the first place in differentiating the species than by all of the characteristics of size, ornamentation and some distinctive characteristics such as appendages and the way of veins arrangement.

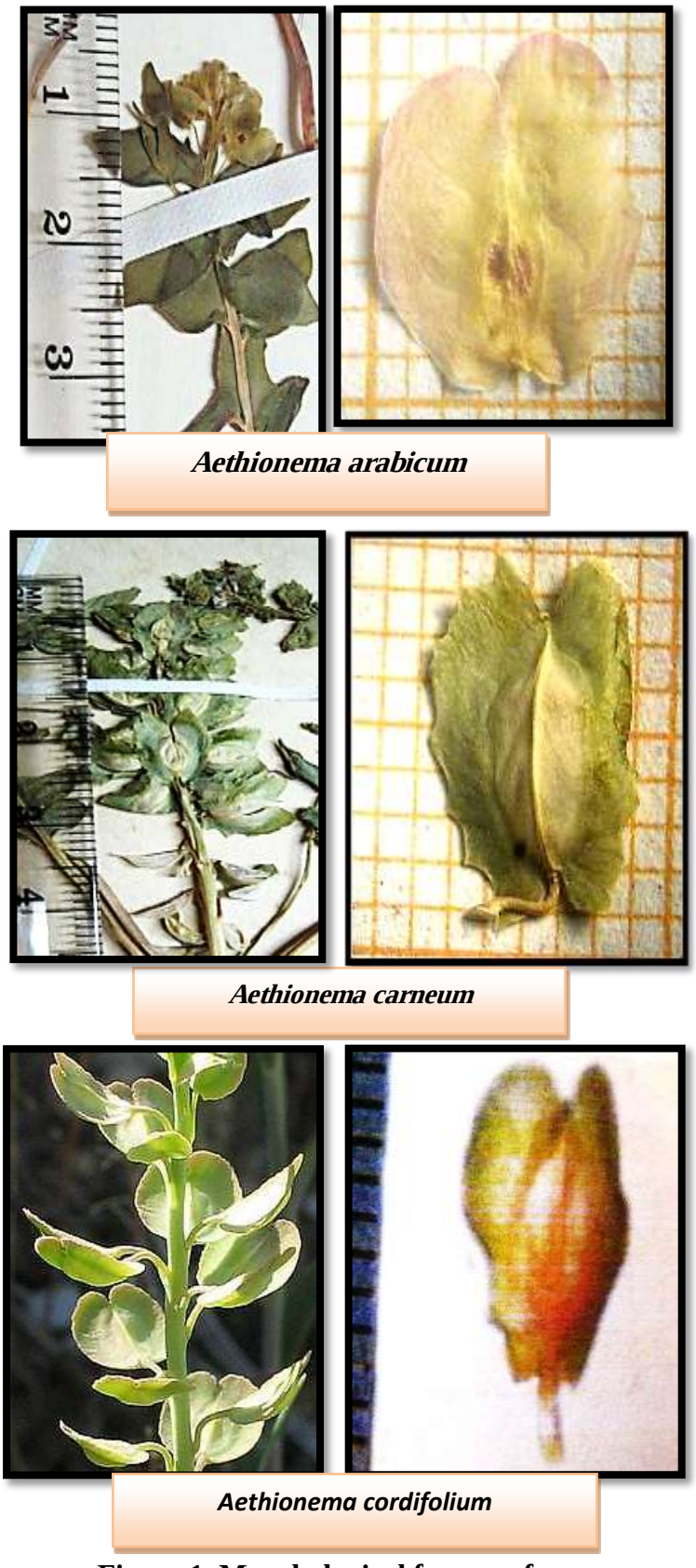

Figure 1. Morphological features for species belong to Lepidieae tribe

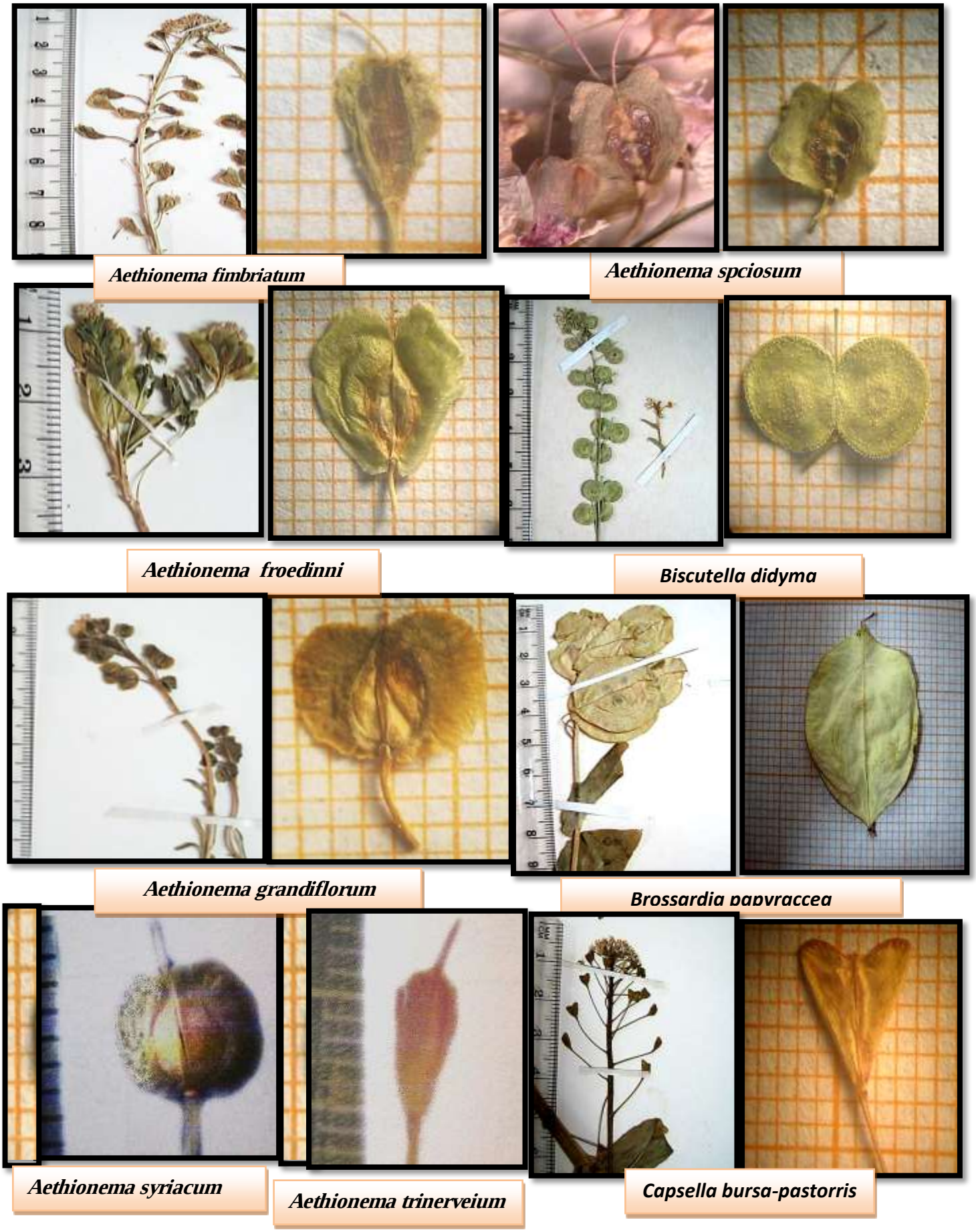

Figure 2. Morphological features for species belong to Lepidieae tribe

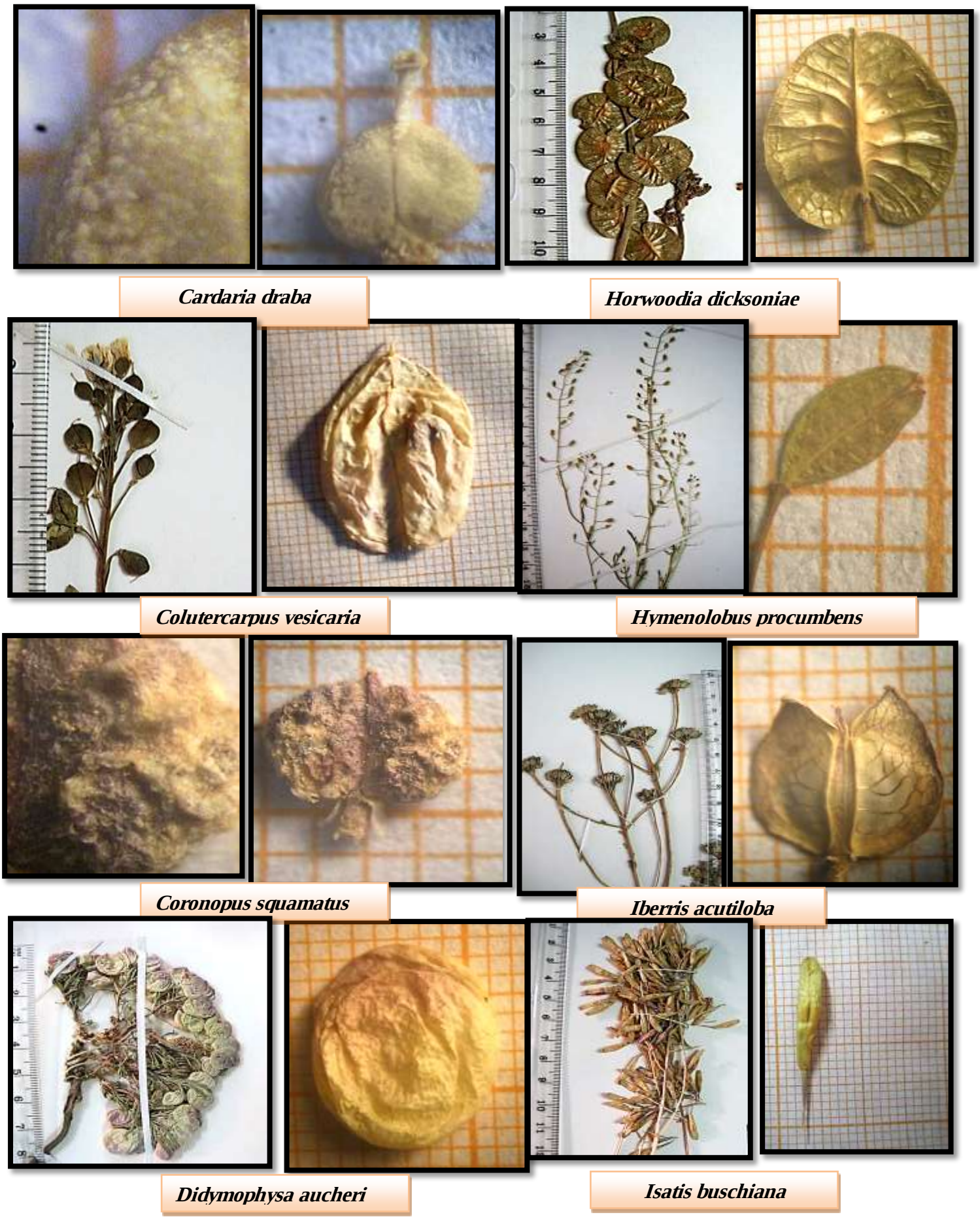

Figure 3. Morphological features for species belong to Lepidieae tribe

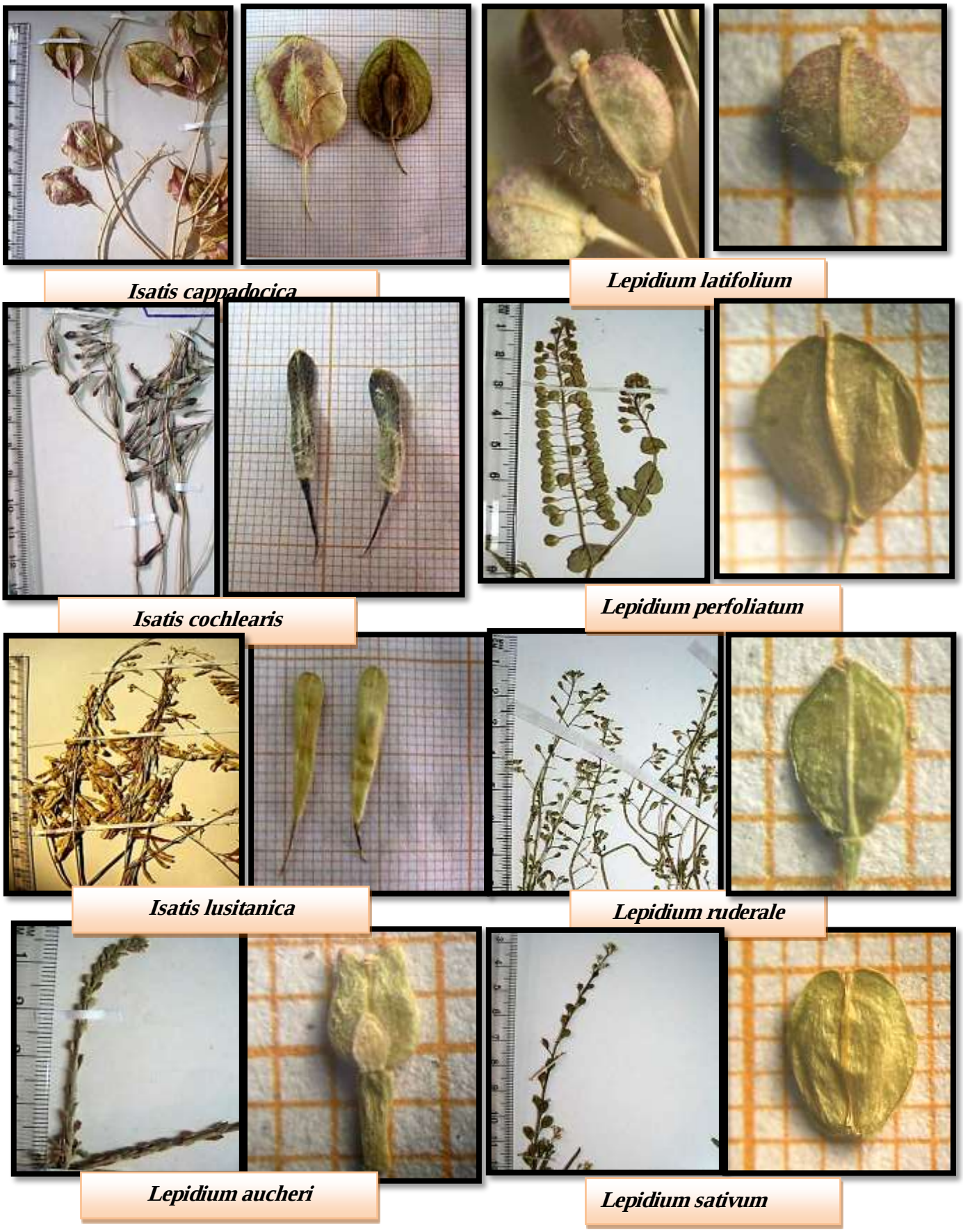

Figure 4. Morphological features for species belong to Lepidieae tribe

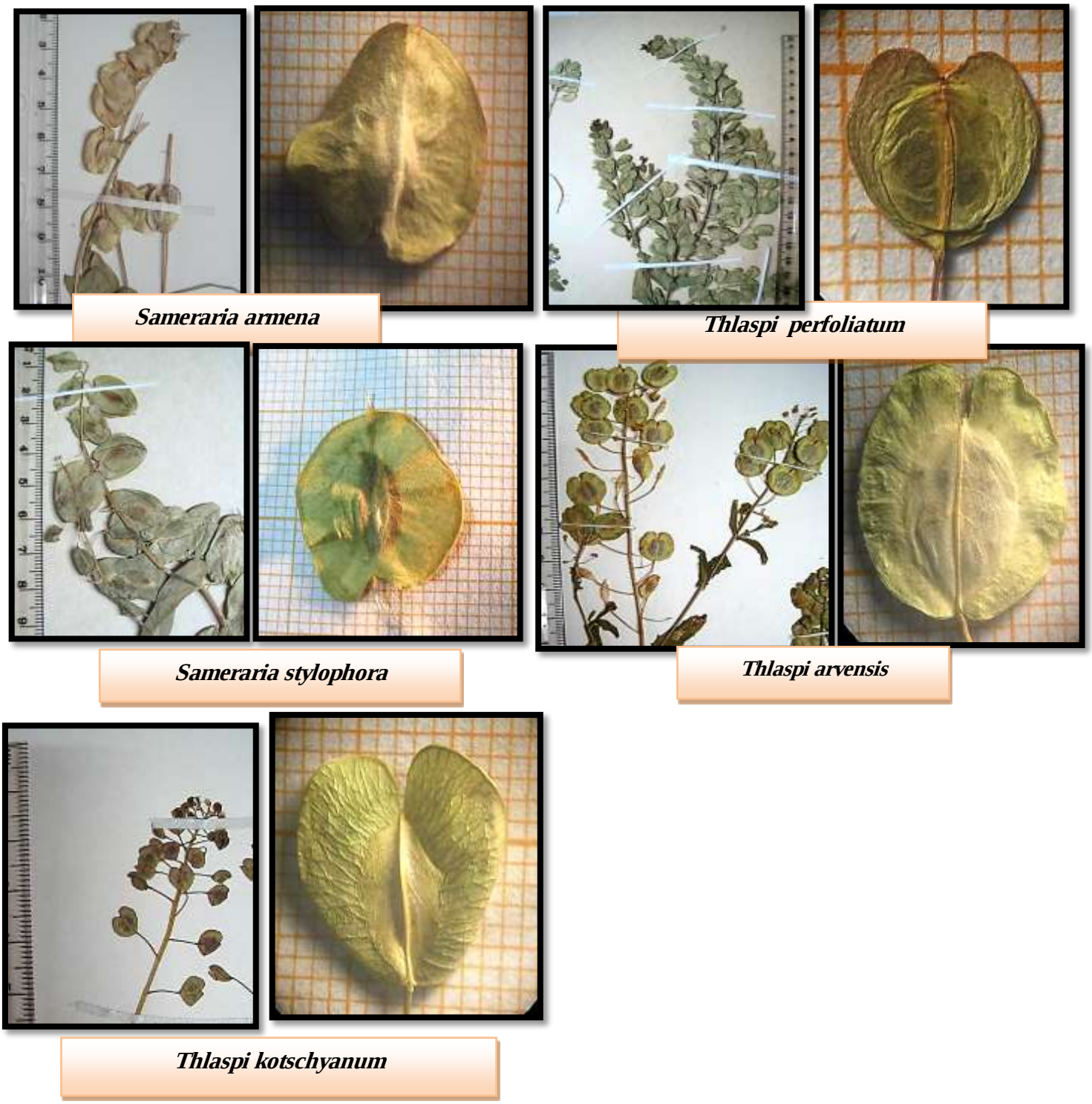

Figure 5. Morphological features for species belong to Lepidieae tribe

Table 1. The characteristics and dimensions of the fruits of the Lepidieae tribe species

No.	Species	Fruit apex	Surface ornamentation	Fruit edge	Beak length	Fruit color	Fruit shape	Fruit width mm.	Fruit length mm.	notable character for genus
1	Aethionema arabicum	emargiant	Semi glabrous	entire	archaeological	Pink to purple in edge	orbicular	7	8	Winged fruit
2	Ae. carneum	emargiant	Semi glabrous	dentate	Short 0.25	green	Wide elliptic	6	8	___
3	Ae. coridifolium	emargiant	glabrous	entire	archaeological	green	Wide elliptic	3	5	___
4	Ae.fimbriatum	rounded	glabrous	laciniate	2	brown	peariform	3	5	___
5	Ae. froedinnii	emargiant	pilose	entire	1.5	Light green	cordate	8	9	___
6	Ae. grandiflorum	rounded	Semi glabrous	undulate	1	brown	circular	6	6	___
7	Ae .speciosum	rounded	tuberculate	undulate	2.5	green	Wide elliptic	2.5	3	___
8	Ae. syriacum	rounded	tuberculate	entire	2	Yellowish green	orbicular	5	5	___
9	Ae. Trinervium	entire	tuberculate	entire	2.5	Light brown	oblong-obovate	2.5	5	___
10	Biscutelladidyma	rounded	glandular	entire	2.5	green	bilobed	11	5.5	bilobed
11	Brossardia papyracea	acute	glandular	entire	3	yellow	Wide elliptic & flatted	23	25	Wide elliptic & flatted
12	Capsella bursa-pastoris	rounded	muricate	entire	archaeological	yellow	Semi triangular	6	7	Semi triangular
13	Cardaria draba	rounded	tuberculate	entire	1	Yellowish brown	ovoid	1.5	1.5	Coarse tuberculate
14	Coluteocarpus vesicaria	acute	muricate	entire	3	Light yellow	vesicular	20	25	vesicular
15	Coronopus squamatus	acute	muricate	Semi entire	0.5	Dark brown - black	obcordate	4	3	Ob-cordate
16	Didymophysa aucheri	rounded	muricate	entire	1	Yellow with purple apex	Bi vesiculate	9	11	Bi vesiculate
17	Horwoodia Dicksoniae	rounded	pilose	entire	0.5	yellow	orbicular	15	15	with prominent veins

Table 2. The characteristics and dimensions of the fruits of the Lepidieae tribe species

No.	Species	Fruit apex	Surface ornamentation	Fruit edge	Beak length	Fruit color	Fruit shape	Fruit width mm.	Fruit length mm.	notable character for genus
18	Hymenolobus procumbens	acute	glabrous	entire	archaeological	green	elliptic	2	3	elliptic
19	*Iberis acutiloba*	emargiant	tuberculate	entire	1	green	orbicular	6	6	orbicular
20	*Isatis buschiana*	rounded	glabrous	entire	archaeological	yellow	Linear to oblong	3	13	Oblong to linear
21	*I. cappadocica*	Acute rounded	pilose	Entire-undulate	archaeological	Yellow-brown	Undulate orbicular	20	20	Orbicular with prominent vein
22	*I. cochlearis*	rounded	tomentose	entire	archaeological	Black with white base	Linear - oblong	3	14	Black with white hairs
23	*I. lusitanica*	rounded	tomentose	entire	archaeological	yellow	Linear - oblong	3	17	Yellow with hairs
24	*Lepidium aucheri*	rounded	tomentose	entire	Wide capitated	green	elliptic	1.5	2.5	elliptic
25	*L. latifolium*	rounded	tomentose	entire	Wide capitated	Green	circular	1.5	1.5	with brown apex
26	*L. perfoliatum*	emargiant	muricate	entire	0.5	Greenish brown	elliptic	3.5	4.5	_____
27	*L. ruderale*	emargiant	tuberculate	entire	Wide capitated	green	elliptic	1.5	3	_____
28	*L. sativum*	emargiant	tuberculate	entire	Wide capitated	Green	elliptic	3.3	5	
29	Sameraria armena	rounded	tomentose	entire	0.5	yellow	Circular	14	14	with central acute appendix
30	S. stylophora	rounded	tomentose	entire	2	Light green	Circular	15	15	with central circular appendix
31	Thlaspiarvensis	emargiant	glabrous	undulate	archaeological	Light green	Circular	13	13	with a smooth groove apex
32	Th. kotschanum	emargiant	glabrous	entire	archaeological	green	Semi circular	6	5.5	_____
33	Th. perfoliatum	emargiant	glabrous	entire	archaeological	green	Semi circular	11	11	_____

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